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EARTH RESOURCES

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A CONTINUING BIBLIOGRAPHY WITH INDEXES

ISSUE 2

MARCH 1975

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

Remote Sensing of Earth Resources (NASA SP-7036(01))

Earth Resources (NASA SP-7041(01))

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EARTH RESOURCES

**A Continuing Bibliography
With Indexes
Issue 02**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1974 and June 1974 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*



Scientific and Technical Information Office

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MARCH 1975

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INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 586 reports, articles, and other documents announced between April and June 1974 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

- IAA* entries identified by accession number series A 74-10,000 in ascending accession number order;

- STAR* entries identified by accession number series N 74-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

- subject, personal author, corporate source, contract number and report/accession number.

AVAILABILITY OF CITED PUBLICATIONS

IAA ACCESSIONS⁽¹⁾ (N74-10000 Series)

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TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT → **AVAILABLE ON MICROFICHE**

NASA ACCESSION NUMBER → **N74-16325*** # **Environmental Research and Technology, Inc.** ← **CORPORATE SOURCE**
 Lexington, Mass.

TITLE → **ANALYSIS OF AIRCRAFT MICROWAVE MEASUREMENTS OF THE OCEAN SURFACE** Final Report, Aug. 1972 - 4 Aug. 1973

CONTRACT OR GRANT → James H. Willand, Mary Grace Fowler, Edward C. Reifstein, III, and David T. Chang Dec 1973 185 p refs (Contract NAS5-21828) ← **PUBLICATION DATE**

REPORT NUMBER → (NASA-CR-132923; P-442) Avail NTIS HC \$11.25 CSCL 04B ← **AVAILABILITY SOURCE**

A data system was developed to process, from calibrated brightness temperature to computation of estimated parameters, the microwave measurements obtained by the NASA CV-990 aircraft during the 1972 Meteorological Expedition. A primary objective of the study was the implementation of an integrated software system at the computing facility of NASA/GSFC, and its application to the 1972 data. A single test case involving measurements away from and over a heavy rain cell was chosen to examine the effect of clouds upon the ability to infer ocean surface parameters. The results indicate substantial agreement with those of the theoretical study; namely, that the values obtained for the surface properties are consistent with available ground-truth information, and are reproducible except within the heaviest portions of the rain cell, at which nonlinear (or saturation) effects become apparent. Finally, it is seen that uncorrected instrumental effects introduce systematic errors which may limit the accuracy of the method. Author

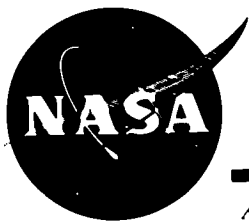
TYPICAL CITATION AND ABSTRACT FROM /AA

NASA SPONSORED DOCUMENT → **AVAILABLE ON MICROFICHE**

AIAA ACCESSION NUMBER → **A74-14019*** # **Detection of particulate air pollution plumes from major point sources using ERTS-1 imagery.** ← **TITLE**
 W. A. Lyons and S. R. Pease (Wisconsin, University, Milwaukee, Wis.). *American Meteorological Society, Bulletin*, vol. 54; Nov. 1973, p. 1163-1170, 14 refs. Research supported by the State of Wisconsin Department of Natural Resources. U.S. Environmental Protection Agency Grant No. R-800873; Contract No. NAS5-21736. ← **AUTHOR**

AUTHOR'S AFFILIATION → The Earth Resources Technology Satellite (ERTS-1) launched by NASA in July 1972 has been providing thousands of high resolution multispectral images of interest to geographers, cartographers, hydrologists, and agronomists. It has been found possible to detect the long-range (over 50 km) transport of suspected particulate plumes from the Chicago-Gary steel mill complex over Lake Michigan. The observed plumes are readily related to known steel mills, a cement plant, refineries, and fossil-fuel power plants. This has important ramifications when discussing the interregional transport of atmospheric pollutants. Analysis reveals that the Multispectral Scanner Band 5 (0.6 to 0.7 micrometer) provides the best overall contrast between the smoke and the underlying water surface. F.R.L. ← **TITLE OF PERIODICAL**

CONTRACT OR GRANT → ← **PUBLICATION DATE**



01

AGRICULTURE AND FORESTRY

Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

- A74-21463** Determination of spectral reflectance using aerial photography. D. Q. McDowell and M. R. Specht (Eastman Kodak Research Laboratories, Rochester, N.Y.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 408-423.

Basic concepts are discussed together with in situ reflectance measurements, aspects of aerial photography, and problems of data reduction. A number of modifications in the technique are suggested on the basis of the conducted analysis. Reflectance curves are predicted for a selected farm site with an average standard error of 0.0061 for samples of five different field crops. G.R.

- A74-24198 *** Satellite imagery for assessing range fire damage in the Nebraska Sandhills. P. M. Seevers, P. N. Jensen (Soil Conservation Service, Lincoln, Neb.), and J. V. Drew (Nebraska University, Lincoln, Neb.). *Journal of Range Management*, vol. 26, Nov. 1973, p. 462, 463. 5 refs. Contract No. NAS5-21756.

- A74-25111** Interpretation and mapping of natural vegetation. S. A. Morain (Kansas University, Lawrence, Kan.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 127-165. 63 refs.

Remote sensing research in the field of natural vegetation is considered from the two viewpoints of (1) the capability of various sensor systems to provide needed data, and (2) the applicability of remote sensing data to the production of floristic, physiognomic, structural, and ecological vegetation maps. It is shown that, with respect to vegetation analysis, our knowledge about the strategies of the uses to which the various sensors may be put is still in its infancy. A wealth of opportunities exists for mapping phenomena not easily surveyed by ground data collection alone. Yet, remote sensing is not a substitute for detailed field surveys. M.V.E.

- A74-25113** Remote sensing of agricultural resources. R. R. Thaman (California University, Santa Barbara, Calif.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 189-223. 118 refs.

The usefulness of remote sensing techniques is discussed for the generation of data on the world's agricultural resources. Major themes covered include: (1) the present means of generating agricultural data; (2) how the use of remote sensing techniques might improve the generation of such data; (3) the advantages and limitations of remote sensing in the agricultural information context; (4) factors which should be considered in the implementation of agricultural surveys using remote sensing techniques; and (5) operational surveys and research conducted in the field of agricultural

remote sensing. Special attention is given to the use of remote sensing in both developed and developing areas of the world. M.V.E.

- A74-25398** Automated approach to the biological survey for pest management systems. P. D. Fisher, R. H. Caron, R. L. Walton, and D. L. Haynes (Michigan State University, East Lansing, Mich.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 227-247. 12 refs. Research supported by the Michigan State University; NSF Grant No. GI-20.

An approach to pest insect management is shown. Through this approach multifactor control strategies can be systematically developed and modified from region to region according to day-to-day changes in weather, field, and economic factors. A method for a biological survey which is compatible with this approach to pest insect management is presented. The basic approaches for gathering the required data are described along with details concerning the hardware required for retrieving, storing and processing the raw data. Problems associated with data management and pattern recognition are discussed. An efficient algorithm for performing object isolation in an image plane is also presented and applied to three representative images. G.R.

- A74-25401** Interpretation of satellite photo with and without support aerial photography for soil and land use mapping. G. Krishnamurti and T. R. Srinivasan (Indian Photo-Interpretation Institute, Dehra Dun, India). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 281-287. 8 refs.

- A74-25419 *** Light reflectance of leaf constituents. H. W. Gausman (U.S. Department of Agriculture, Weslaco, Tex.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 585-599. 12 refs. NASA Order R-09-038-002.

It is shown how various leaf constituents differ in reflecting light over the 370- to 1100-nm wavelength interval. The premise tested is that refractive index discontinuities in leaves, other than air-cell interfaces, contribute to the reflectance of near-infrared light. M.V.E.

- A74-25420** Measurement of the combined effect of green biomass, chlorophyll, and leaf water on canopy spectrorreflectance of the shortgrass prairie. C. J. Tucker, L. D. Miller, and R. L. Pearson (Colorado State University, Fort Collins, Colo.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 601-627. 21 refs. NSF Grants No. GB-7824; No. GB-13096; No. GB-31862X; No. GB-31862X2.

- A74-25421 *** Effects of changing canopy directional reflectance on feature selection. J. A. Smith, R. E. Oliver (Colorado State University, Fort Collins, Colo.), and O. E. Kilpela. In: Remote

sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2.

Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 629-641. 11 refs. Grant No. DA-ARO(D)-31-124-71-G165; Contract No. NAS9-12972.

The use of a Monte Carlo model for generating sample directional reflectance data for two simplified target canopies at two different solar positions is reported. Successive iterations through the model permit the calculation of a mean vector and covariance matrix for canopy reflectance for varied sensor view angles. These data may then be used to calculate the divergence between the target distributions for various wavelength combinations and for these view angles. Results of a feature selection analysis indicate that different sets of wavelengths are optimum for target discrimination depending on sensor view angle and that the targets may be more easily discriminated for some scan angles than others. The time-varying behavior of these results is also pointed out.

M.V.E.

A74-25422 Spatial and temporal variations of crop canopy temperatures and implications for irrigation scheduling. P. R. Nixon, L. N. Namken, and C. L. Wiegand (U.S. Department of Agriculture, Weslaco, Tex.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 643-657. 9 refs.

Investigation of spatial and temporal variations in crop canopy temperatures under existing farming practice. The temperatures were measured shortly after solar noon by an airplane-mounted precision-radiation thermometer. The results include the finding that the temperature of fallow and most cropped fields increased noticeably with time after irrigation and rainfall.

M.V.E.

A74-25423 Seasonal changes in the spectral character of reflectance from three California annual rangeland sites. E. H. Roberts and M. J. Gialdini (California, University, Berkeley, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 659-667.

A74-25424 Effect of altitude on crop classification accuracy. E. E. Nelson (McDonnell Douglas Corp., Huntington Beach, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 669-687. 5 refs.

A study of the effect of altitude on crop classification accuracy has been conducted using multispectral scanner data. These data were collected in the same spectral bands as ERTS-1 on aircraft flights at 6,000 and 12,000 feet over the University of California at Riverside Agricultural Farm. The results of the computer classification showed no difference in accuracy at these two altitudes for three categories - cereal grain, sugar beets, and fallow ground. A more detailed inspection of the spectral data revealed that the increase in altitude had three effects on the radiance values: (1) an increase in average value due to atmospheric scattering, (2) a decrease in variance due to averaging within the larger IFOV, and (3) a decrease in contrast between crop types, again due to atmospheric scattering.

(Author)

A74-25425 Visible and infrared remote sensing in soil moisture determination. J. I. Sewell (Tennessee, University, Knoxville, Tenn.) and W. H. Allen. In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 689-702. 11 refs. Project THEMIS.

A laboratory study of fallow soil reflectance and soil moisture content at nine wavelengths from 0.36 to 0.75 micrometer showed that at each wavelength, the relationship was described by quadratic functions. A field study utilizing fallow plots with controlled soil moisture, visible and infrared airborne sensors and appropriate ground data showed that the response data were related to soil moisture content. Color infrared film, better than black-and-white infrared film or electronic line scanner imagery, enhanced visual interpretation of soil moisture differences. The detection and classification of fallow soil moisture is feasible over the 1 to 24 percent dry weight of soil moisture for the soil of this study.

(Author)

A74-25426 Computer mapping of wet-land soils using color infrared photography. A. J. Lewis, P. B. Larimore, and S. T. Kim (Louisiana State University, Baton Rouge, La.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 703-720. 11 refs. Research supported by the Louisiana State University.

A74-25427 * Remote identification of soil conditions with ratioed multispectral data. T. W. Wagner, R. Dillman, and F. Thomson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 721-738. 23 refs. NASA-supported research.

Some of the information concerning soils that a multispectral scanner system may provide is discussed, and a practical approach for realizing this potential is suggested. Some reflectance and emittance characteristics of soil surfaces are reviewed, and the feasibility of selectively enhancing contrasts associated with differing soil conditions is demonstrated. The simplicity of the proposed ratio technique, its relative economy, and the compatibility of the image output with conventional survey methods commends it for consideration as an operational method.

M.V.E.

A74-25438 Mapping phenological change using ERTS-1 imagery. M. D. Ashley, J. Rea (Maine, University, Orono, Me.), and B. E. Dethier (Cornell University, Ithaca, N.Y.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 899-913. 12 refs.

A research program involving mapping of phenological or seasonal events for specific forest and crop types using Earth Resources Technology Satellite (ERTS-1) imagery is described. Computer programs working with ERTS-1 multispectral scanner analog tapes in all bands are being used to give relative changes in spectral reflectance over time of forests, range grasses, and specified crops for the study's 24 sites located within four corridors across the United States. It is shown that specific phenological events such as crop maturity or leaf fall can be mapped for specific sites and possibly for entire regions.

F.R.L.

A74-25440 * Vegetation boundaries on ERTS-1 imagery. H. R. DeSelm and T. W. Taylor (Tennessee, University, Knoxville, Tenn.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 925-933. 14 refs. NASA-supported research.

Comparison of systems corrected ERTS-1 imagery and microdensitometer scan printouts derived from them with base vegetation maps and current 1:120,000 and 1:60,000 scale imagery of the Great Smoky Mountains is in progress. It reveals good separation of the

spruce-fir forest from the other forest areas but band seven does not distinguish between hardwood and heath dominated vegetation.

(Author)

A74-25448 * The use of high altitude and earth orbital ERTS-1 imagery in an analysis of northern California wildland environments. P. F. Krumpke (California, University, Berkeley, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1029-1048. 9 refs. Contract No. NAS5-21827; Grant No. NGL-05-003-404.

A74-25452 Determination of the water content in the atmosphere over the soil surface. Iu. I. Rabinovich and G. G. Shchukin (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Moscow, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1107-1120. 11 refs.

A74-26180 Color for shrubs. R. S. Driscoll and M. D. Coleman (U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.). *Photogrammetric Engineering*, vol. 40, Apr. 1974, p. 451-459. 12 refs.

The results of research are reviewed devoted to defining the season and photoscale threshold for the most accurate identification of shrub species on large-scale 70-mm color and color-infrared film. Seven of 11 shrub species were identified correctly more than 80% of the time on color infrared; two were correctly identified 100% of the time. M.V.E.

A74-26181 An Apollo photo and the Texas-New Mexico line. C. C. Reeves, Jr. (Texas Tech University, Lubbock, Tex.). *Photogrammetric Engineering*, vol. 40, Apr. 1974, p. 461-465.

Ground-truth studies of Apollo photo 26A-3807A show a correlation between Pleistocene eolian sheet sands, tillable soils, availability of irrigation water and agricultural development. Areas of near-surface Pliocene caliche, although underlain by saturated Ogallala aquifer, are not tillable, whereas areas of Pleistocene eolian sand underlain by saturated Ogallala aquifer exhibit an agricultural signature nonidentical on either side of the New Mexico-Texas state line. A therefrom arisen controversy is examined, and the attempt is made to settle the argument concerning the state line signature. M.V.E.

A74-26275 The spectral reflectance of a vegetation-covered surface. I - Method and application (Das spektrale Reflexionsvermögen einer bewachsenen Oberfläche. I - Methode und Anwendung). K. T. Kriebel (München, Universität, Munich, West Germany). *Beiträge zur Physik der Atmosphäre*, vol. 47, no. 1, 1974, p. 14-44. 23 refs. In German. Research supported by the Bundesministerium für Bildung und Wissenschaft und Deutsche Forschungsgemeinschaft.

A method is presented for calculating the spectral bidirectional reflectance distribution function from the reflected and incoming radiation field with consideration of the spectral sky radiation. This method is applied to a vegetated homogeneous surface. With an eight-channel radiometer the angular distribution of the spectral radiation field of a savannah near Tsumeb, Southwest Africa, is measured in the spectral range from 0.4 to 2.2 microns by means of an aircraft. The spectral bidirectional reflectance distribution function and the spectral albedo of the savannah are determined. The anisotropy of the bidirectional reflectance distribution function is mostly due to shading effects at the surface. Generally, the sky radiation cannot be neglected in relation to the sun radiation. If the sky radiation is distinctly smaller than the sun radiation, the assumption of isotropic sky radiation is justified, so that the determination of the bidirectional reflectance distribution function becomes simple. (Author)

A74-27881 # Possibilities of remote soil sounding in the centimeter range (Vozmozhnosti distantsionnogo zondirovaniia pochvy v santimetrovom diapazone). K. Ia. Kondrat'ev, E. M. Shul'gina, O. M. Pokrovskii, and Iu. M. Timofeev. In: Radiation studies in the atmosphere. Leningrad, Gidrometeoizdat, 1973, p. 86-97. 17 refs. In Russian.

Outgoing microwave thermal radiation measurements over various terrains are discussed as a basis for the estimation of the vertical temperature distribution in the soil. Informative value assessments are made for radio brightness temperature measurements and for the accuracy of soil temperature profile calculations. Special numerical algorithms are used in solving the respective inverse problems from thermal radiation data, assuming a constant soil moisture content in the depth. Radio brightness temperature measurements are found to provide useful information on one or two independent parameters of a soil temperature profile when the measurements are accurate to 0.5 to 1 deg K. A whole soil temperature profile can be derived with good accuracy when the measurements are accurate to 0.5 deg K. V.Z.

A74-27882 # Radiant capacity of a soil with linearly non-uniform characteristics (Izлучatel'naia sposobnost' pochvy s lineino neodnorodnymi kharakteristikami). E. M. Shul'gina. In: Radiation studies in the atmosphere. Leningrad, Gidrometeoizdat, 1973, p. 98-107. In Russian.

Integral equations are derived for the reflection coefficient of a plane electromagnetic wave which is incident on a semiinfinite layer of soil whose permittivity varies linearly with depth as does the moisture content. A procedure for solving these equations by the successive approximation method is described. Calculations of the radiant capacity of soils by using these equations show that the radiant temperatures of the horizontally polarized radiation emitted by an underlying soil may differ as much as tens of degrees. The differences are caused by soil inhomogeneities and are prominent when the moisture content in the topsoil is low and the remote sounding is made in the decimeter wavelength band. V.Z.

A74-28028 Agriculture, forestry, land use, and mapping helped by ERTS. W. A. Finch (California State University, San Diego, Calif.). *Journal of Environmental Sciences*, vol. 17, Mar.-Apr. 1974, p. 23-29.

The ERTS spacecraft has shown its capability for mapping the earth's natural resources, monitoring air and water pollution, charting land use, and for monitoring crop damage due to pests and disease. The present work gives examples of how ERTS has been used in recent studies of urban development, transportation, pollution, crop classification and mensuration, soil surveying, and forest and wildlife resources management. The data from the ERTS spacecraft are not only accurate, but they can be obtained both quickly and economically. P.T.H.

A74-28507 # Detecting the toxic effects of metals on vegetation from earth observation satellites. N. P. Press (Royal School of Mines, London, England). (*British Interplanetary Society, Symposium on Earth Observation Satellites, University College, London, England, Apr. 10-12, 1973.*) *British Interplanetary Society, Journal*, vol. 27, May 1974, p. 373-384. Research supported by Barringer Research, American Smelting and Refining Co., and Rio Tinto Zinc Corp.

The results of a feasibility study are reviewed on the possibility of using remote sensing techniques for detecting the toxic effects of metals on vegetation. While the possibility of detecting differences between healthy and metal stressed vegetation reflectance spectra is shown not to be ruled out, it is unlikely that observed metal stress symptoms will markedly differ from those of moisture stress, toxicity from saline soils, or the effects of airborne pollution. But it is likely that the combined use of the techniques discussed in conjunction with some geophysical methods may eventually become attractive in the search for economically significant mineral deposits. M.V.E.

N74-16015*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.

DETECTION OF MOISTURE AND MOISTURE RELATED PHENOMENA FROM SKYLAB Monthly Progress Report, Jan. 1974

Joe R. Eagleman, Ernest C. Pogge, Richard K. Moore, Principal Investigators, Norman Hardy, Wen Lin, and Larry League Jan. 1974 31 p refs EREP

(Contract NAS9-13273)
(E74-10254; NASA-CR-136582) Avail: NTIS HC \$3.75 CSCL 08H

The author has identified the following significant results. Skylab 2 data for June 5, 1973 (Texas site) relates favorably with previously calculated aircraft data when correlating brightness temperature to soil moisture. However, more detailed work is needed to determine the corrected surface temperature. In addition, correlations between the S194 antenna temperature and soil moisture have been obtained for five sets of Skylab data. The best correlations were obtained for the surface to one inch depth in four cases and for surface to two inches depth for the fifth case. Correlation coefficients for the surface to one inch depth were -0.98, -0.95, -0.90, -0.82, and -0.80.

N74-16017*# Arizona Univ., Tucson.

A STUDY TO EXPLORE THE USE OF REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Progress Report, period ending 15 Dec. 1973

William G. McGinnies, Principal Investigator 15 Dec. 1973 3 p ERTS

(Contract NAS5-21812)
(E74-10256; NASA-CR-136584) Avail: NTIS HC \$3.00 CSCL 08F

N74-16021*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.

UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Jan. 1974

Harvey K. Nelson, Principal Investigator Jan. 1974 2 p EREP

(NASA Order T-4114-B)
(E74-10260; NASA-CR-136590) Avail: NTIS HC \$3.00 CSCL 06C

N74-16030*# Alaska Univ., Palmer.

IDENTIFICATION OF PHENOLOGICAL STAGES AND VEGETATIVE TYPES FOR LAND USE CLASSIFICATION Bimonthly Progress Report

Jay D. McKendrick, Principal Investigator 6 Feb. 1974 17 p refs ERTS

(Contract NAS5-21833)
(E74-10290; NASA-CR-136677; MPR-9) Avail: NTIS HC \$3.00 CSCL 02F

The author has identified the following significant results. Recent signature identification and refinement techniques indicate that with automated classification of MSS CCT data commercial stands of cottonwood and white spruce can be identified with 80% accuracy in the Bonanza Creek experimental forest. Since that forest is representative of the vast interior Alaska forests, this finding has substantial economic importance to public and private forestry interests in Alaska.

N74-16056*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

A STUDY OF SEDIMENT TRANSPORT AND EROSION IN THE FOURCHON AREA OF SOUTH LOUISIANA

R. P. Self (Nicholls State Univ.) Dec. 1973 30 p refs

(Grant NGL-19-001-105)
(NASA-CR-136676; AOP-3) Avail: NTIS HC \$3.50 CSCL 08H

Aerial photography in the form of color infrared and color positive transparencies were used as aids in evaluating the rate and effect of erosion and sediment transport in Bay Champagne, a coastal marshland of Louisiana. Problems were found in the aerial photography method used. Vegetational differences do not always reflect sediment differences. Only areas containing different soils and sediments are easily defined with aerial photography. The shoreline erosion rate is 75 to 100 ft/yr. Areas which are undergoing erosion shift due to changes in wave refraction. In canals and channels with strong currents, erosion also occurs at a rapid rate. It is recommended that drainage patterns be studied carefully before breaches are made as man-made breaches could reverse drainage.

S.K.W.

N74-16095 Minnesota Univ., Minneapolis.

USE OF HIGH ALTITUDE PHOTOGRAPHY FOR FOREST DISEASE DETECTION AND VEGETATION CLASSIFICATION WITHIN THE SUB-BOREAL FOREST REGION Ph.D. Thesis

Robert Wendell Douglass 1973 150 p

Avail: Univ. Microfilms Order No. 73-25598

Dwarf mistletoe in black spruce subboreal stands, hypoxylon canker in aspen, and Armillaria root rot in pine plantations are studied. A multispectral investigation of an infected site to determine the optimum film/filter/season parameters, and a low, medium, and high altitude aerial photography were used to study the mistletoe. Hypoxylon canker was indicated by presence of persistent dead foliage. Large scale photography was used to detect Armillaria root rot.

Dissert. Abstr.

N74-17055 Colorado State Univ., Fort Collins.

REMOTE MULTISPECTRAL SENSING OF BIOMASS Ph.D. Thesis

Robert Lawrence Pearson 1973 208 p

Avail: Univ. Microfilms Order No. 73-29057

An ecosystem analysis study is reported on an entire shortgrass prairie biome using systems analysis techniques. One of the most important spatial parameters of the grassland biome which must be determined on an areal basis is the amount of vegetation present on the prairie at a particular place and time. Small area biomass estimates have been made with a two channel spectral ratio method using a small hand-held radiometer with a biomass estimation accuracy of greater than 95%. Large area biomass determinations have been tested on multispectral scanner data using both a channel ratio technique and multispectral pattern recognition techniques. The resulting biomass maps show correlations with several ground truth sites of from 80% and 90% between the estimated biomass values from the multispectral data of an area and biomass values taken from clipped plots in the same area.

Dissert. Abstr.

N74-17059*# Agricultural Research Service, Weslaco, Tex.

REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Jun. - 19 Dec. 1973

Craig L. Wiegand, H. W. Gausman, R. W. Leamer, A. J. Richardson, and A. H. Gerbermann, Principal Investigators Feb. 1974 59 p refs ERTS

(NASA Order S-70251-AG)
(E74-10265; NASA-CR-136651) Avail: NTIS HC \$5.00 CSCL 20F

The author has identified the following significant results.

Iron deficient and normal grain sorghum plants were sufficiently different spectrally in ERTS-1 band 5 CCT data to detect chlorotic sorghum areas 2.8 acres (1.1 hectares) or larger in size in computer printouts of the MSS data. The ratio of band 5 to band 7 or band 7 minus band 5 relates to vegetation ground cover conditions and helps to select training samples representative of differing vegetation maturity or vigor classes and to estimate ground cover or green vegetation density in the absence of ground information. The four plant parameters: leaf area index, plant population, plant cover, and plant height explained 87 to 93% of the variability in band 6 digital counts and from 59 to 90% of the variation in bands 4 and 5. A ground area 2244 acres in size was classified on a pixel by pixel basis using simultaneously acquired aircraft support and ERTS-1 data. Overall recognition for vegetables, immature crops and mixed shrubs, and bare soil categories was 64.5% for aircraft and 59.6% for spacecraft data, respectively. Overall recognition results on a per field basis were 61.8% for aircraft and 62.8% for ERTS-1 data.

N74-17061*# California Univ., Berkeley. Center for Remote Sensing Research.

AGRICULTURAL INTERPRETATION TECHNIQUE DEVELOPMENT Quarterly Progress Report

Robert N. Colwell, Andrew S. Benson, Principal Investigators. Claire M. Hay, Nancy A. Jones, and Catherine E. Brown 30 Nov. 1973 15 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS2-7567) (E74-10267; NASA-CR-136653) Avail: NTIS HC \$3.00 CSCL 02D

N74-17066*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS
Progress Report, 1-30 Nov. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 30 Nov. 1973 2 p EREP (NASA Order T-4109-B) (E74-10272; NASA-CR-136658; PR-10) Avail: NTIS HC \$3.00 CSCL 06C

N74-17068*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, 28 Nov. 1973 - 27 Jan. 1974
J. W. Rouse, Jr., Principal Investigator 27 Jan. 1974 10 p ERTS (Contract NAS5-21857) (E74-10274; NASA-CR-136660; PR-6) Avail: NTIS HC \$3.00 CSCL 06F

The author has identified the following significant results. Primary emphasis during the period has been given to completing the resource and land use mask overlays for ultimate subsite MSS data extraction and analysis, refining the computer mask program, verifying resultant masks, and evaluating the initial subsite data. Standard deviations for the selected subsites were generally reduced significantly when compared to the values for the overall 7km x 7km test site areas. This indicates that the masking technique has been successful in reducing the variability of the ERTS-1 MSS data for ultimate subsite comparisons with ground data. The techniques used to locate the 7km x 7km test site areas and extract masked subsite data apparently limit

the ability to reliably locate identical very small subsite areas for temporal comparisons. Current evidence indicates that areas which include less than about four pixel elements in either dimension are probably unreliable.

N74-17074*# Cornell Univ., Ithaca, N.Y. Div. of Atmospheric Sciences.

PHENOLOGY SATELLITE EXPERIMENT Progress Report, Feb. - Aug. 1973

Bernard E. Dethier, M. Ashley (Maine Univ.), B. Blair (Purdue Univ.), J. Caprio (Montana State Univ.), R. Hopp (Vermont Univ.), and J. Rouse, Jr., Principal Investigators (Texas A and M Univ.) 15 Oct. 1973 73 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-21781) (E74-10282; NASA-CR-136668) Avail: NTIS HC \$5.75 CSCL 02F

The author has identified the following significant results. The 1972 Brown Wave and 1973 Green Wave were detected at 24 sites located in four north-south corridors across the United States through analysis of ERTS-1 imagery and multispectral scanner digital tapes. Ground observations from these sites were correlated with ERTS data. These two phenological events were documented by observations from more than 3200 sites across the United States. The problem of changing atmospheric and illumination conditions were studied and corrections to ERTS data suggested. Band-to-band ratios were developed and correlated with the fall and spring phenological changes in field crops and forests. The results to date show the feasibility of developing and refining phenoclimatic models for use in characterizing crop status and as an aid to yield prediction.

N74-17078*# Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, 8 Aug. - 8 Oct. 1973
Bernard E. Dethier, Principal Investigator 8 Oct. 1973 3 p ERTS (Contract NAS5-21781) (E74-10288; NASA-CR-136674) Avail: NTIS HC \$3.00 CSCL 02F

N74-17079*# Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, 8 Oct. - 8 Dec. 1973
Bernard E. Dethier, Principal Investigator 8 Dec. 1973 2 p refs ERTS (Contract NAS5-21781) (E74-10289; NASA-CR-136675) Avail: NTIS HC \$3.00 CSCL 02F

N74-17080*# Alaska Univ., Fairbanks.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Bimonthly Progress Report
Peter C. Lent, Principal Investigator 31 Jan. 1974 5 p refs ERTS (Contract NAS5-21833) (E74-10291; NASA-CR-136678; B-MPR-9) Avail: NTIS HC \$3.00 CSCL 06C

The author has identified the following significant results. A multiband classification scheme was applied to ERTS-1 MSS digital tape data in a portion of the Yukon Flats area. Primary analytic objectives of mapping the extent of recent wildfire burns and mature forest were realized illustrating application to moose and caribou biology. Additionally, the analysis indicated the presence of new lakes as well as disappearance of lakes present in 1956. Because this is an important waterfowl production area,

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similar analyses may have significant application potential to waterfowl biology for rapid updating of habitat information. Further field confirmation of this finding is required.

N74-17085*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 16 Dec. 1973 - 15 Jan. 1974

Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 20 Jan. 1974 7 p EREP

(NASA Order T-4106-B)

(E74-10296; NASA-CR-136683; MPR-9) Avail: NTIS HC \$3.00 CSCL 02F

The author has identified the following significant results. Some current beetle-killed ponderosa pine can be detected on S190-B photography imaged over the Bear Lodge mountains in the Black Hills National Forest. Detections were made on SL-3 imagery (September 13, 1973) using a zoom lens microscope to view the photography. At this time correlations have not been made to all of the known infestation spots in the Bear Lodge mountains; rather, known infestations have been located on the SL-3 imagery. It was determined that the beetle-killed trees were current kills by stereo viewing of SL-3 imagery on one side and SL-2 on the other. A successful technique was developed for mapping current beetle-killed pine using MSS imagery from mission 247 flown by the C-130 over the Black Hills test site in September 1973. Color enhancement processing on the NASA/JSC, DAS system using three MSS channels produced an excellent quality detection map for current kill pine. More importantly it provides a way to inventory the dead trees by relating PCM counts to actual numbers of dead trees.

N74-17094*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jul. - 31 Dec. 1973

Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 20 Jan. 1974 28 p ref Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70251-AG)

(E74-10306; NASA-CR-136788; FS-II-3; PR-3) Avail: NTIS HC \$4.50 CSCL 02F

The author has identified the following significant results. Disturbances in a forest environment that cause reductions in forest area, timber volume, and timber growth can be detected on ERTS-1 combined color composites. However, detection depends on comparing a conventional aerial photograph taken at some base year with an ERTS-1 image taken in some subsequent year. In a test made on the Atlanta site, 1:63,360 scale aerial photo index sheets made in 1966 were compared with ERTS-1 image 1264-15445 (April 1973). Five factors were found important to detection reliability: (1) the quality of the imagery; (2) the season of the imagery; (3) the size of the disturbed area; (4) the number of years since the disturbances; and (5) the type of cutting treatment. Of 209 disturbances verified on aerial photography, 165 (or approximately 80%) were detected on the ERTS-1 image by one independent interpreter. Improved training and additional experience in using this low resolution imagery should improve detection. Of the two seasons of data studies (fall and early spring), early spring is the best for detecting land use changes. Generally speaking, winter, early spring, and early summer are the best times of year for detecting forest disturbances.

N74-17097*# South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING

MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Jan. 1974

Victor J. Myers, Principal Investigator 1 Jan. 1974 2 p EREP (Contract NAS9-13337)

(E74-10310; NASA-CR-136792) Avail: NTIS HC \$4.00 CSCL 08M

N74-17098*# Michigan State Univ., East Lansing.

INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Jan. 1974

Lester V. Manderscheid, Principal Investigator Jan. 1974 3 p EREP

(Contract NAS9-13332)

(E74-10311; NASA-CR-136796) Avail: NTIS HC \$4.00 CSCL 05B

N74-17099*# Wyoming Univ., Laramie. Dept. of Geology.

IDENTIFICATION OF IRRIGATED CROP TYPES FROM ERTS-1 DENSITY CONTOUR MAPS AND COLOR INFRARED AERIAL PHOTOGRAPHY Special Report

Ronald W. Marrs and Michael A. Evans 15 Jan. 1974 16 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21799)

(E74-10312; NASA-CR-136797; ERTS-1-S74-1) Avail: NTIS HC \$4.00 CSCL 02C

The author has identified the following significant results. The crop types of a Great Plains study area were mapped from color infrared aerial photography. Each field was positively identified from field checks in the area. Enlarged (50x) density contour maps were constructed from three ERTS-1 images taken in the summer of 1973. The map interpreted from the aerial photography was compared to the density contour maps and the accuracy of the ERTS-1 density contour map interpretations were determined. Changes in the vegetation during the growing season and harvest periods were detectable on the ERTS-1 imagery. Density contouring aids in the detection of such charges.

N74-17100*# Agricultural Research Service, Weslaco, Tex. **IRRIGATION SCHEDULING, FREEZE WARNING AND SOIL SALINITY DETECTING** Monthly Progress Reports, Nov. 1973 - Jan. 1974

Craig L. Wiegand, Principal Investigator 15 Feb. 1974 4 p EREP

(NASA Order T-4105-B)

(E74-10313; NASA-CR-136798; MPR-5) Avail: NTIS HC \$4.00 CSCL 02C

N74-17103*# Natural Resources Management Corp., Berkeley, Calif. Research and Development Div.

INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Jun. - 30 Sep. 1973

Ralph C. Hall, Principal Investigator 30 Nov. 1973 7 p ERTS

(Contract NAS5-21770)

(E74-10318; NASA-CR-136807) Avail: NTIS HC \$4.00 CSCL 06C

The author has identified the following significant results. In earlier reports it has been indicated that it is possible to delineate areas of lodgepole pine timber mortality into three degrees of damage from enlarged ERTS-1 color composites: light, medium, and heavy. It can also be confidently reported that it

is now possible to detect all major areas of lodgepole pine defoliated by the needle miner. It has also been confirmed, through ground checking and helicopter observation that previous designation of the following features have been consistently accurate: timbered vs non-timbered areas; timber types; damaged vs undamaged areas; lakes, dome shadows which resemble lakes, mountain meadows, pasture and agricultural land, desert; riparian vegetation; and glaciers.

N74-17996* South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Feb. 1974

Victor I. Myers, Principal Investigator 1 Feb. 1974 3 p EREP

(Contract NAS9-13337)

(E74-10309; NASA-CR-136791) Avail: NTIS HC \$4.00 CSCL 08M

N74-18002* South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Nov. 1973

Victor I. Myers, Principal Investigator 1 Nov. 1973 2 p EREP

(Contract NAS9-13337)

(E74-10326; NASA-CR-136821) Avail: NTIS HC \$4.00 CSCL 08F

N74-18005* Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.

UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Monthly Progress Report, Feb. 1974

Harvey K. Nelson, Principal Investigator Feb. 1974 3 p EREP

(NASA Order T-4114-B)

(E74-10329; NASA-CR-136824) Avail: NTIS HC \$4.00 CSCL 06C

N74-18010* Agricultural Research Service, Weslaco, Tex. REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Dec. 1973 - 19 Feb. 1974

Craig L. Wiegand, Principal Investigator 20 Feb. 1974 5 p ERTS

(NASA Order S-70251-AG)

(E74-10334; NASA-CR-136845; PR-6) Avail: NTIS HC \$4.00 CSCL 08M

N74-18011* Mississippi State Univ., State College. Inst. for Environmental Studies.

APPLICATION OF ERTS-A DATA TO AGRICULTURAL PRACTICES IN THE MISSISSIPPI DELTA REGION Progress Report

C. W. Bouchillon, Principal Investigator 5 Mar. 1974 2 p ERTS

(Contract NAS5-21881)

(E74-10335; NASA-CR-136846; PR-6) Avail: NTIS HC \$4.00 CSCL 02C

N74-18023* Nebraska Univ., Lincoln.

PROPOSAL TO EVALUATE THE USE OF ERTS-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Jan. - 1 Mar. 1974

James V. Drew, Principal Investigator 1 Mar. 1974 11 p ref ERTS

(Contract NAS5-21756)

(E74-10348; NASA-CR-136865) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. Increase in radiance values is directly related to decrease in vegetative biomass, though not in a linear manner. Should the relationship hold true over an entire growing season, this would allow an extremely rapid evaluation of range condition. Computer access by remote terminal would allow production of this type of range condition evaluation in near real time, which is essential if grazing practice decisions are to be made based on satellite imagery acquisition. Negating the manipulation of photographic products appears to be the logical way to provide satellite imagery data to the user in near real time. There appears to be a direct linear relationship between radiance values of bands 4 and 5 and increase in total inorganic ions (6 ions) of lakes in the Sand hills region. Consistent ion concentration of lakes during the year could allow their radiance values to serve as a means of equating radiance values from image to image.

N74-18024* Oregon State Univ., Corvallis. Agricultural Experiment Station.

INVENTORY AND ANALYSIS OF NATURAL VEGETATION AND RELATED RESOURCES FROM SPACE AND HIGH ALTITUDE PHOTOGRAPHY Remote Sensing Applications in Forestry. Final Report

Charles E. Poulton Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1972 63 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab. in cooperation with Dept. of Agric. Forest Serv.

(NASA Order R-09-038-002)

(NASA-CR-137148) Avail: NTIS HC \$6.25 CSCL 02F

A multiple sampling technique was developed whereby spacecraft photographs supported by aircraft photographs could be used to quantify plant communities. Large scale (1:600 to 1:2,400) color infrared aerial photographs were required to identify shrub and herbaceous species. These photos were used to successfully estimate a herbaceous standing crop biomass. Microdensitometry was used to discriminate among specific plant communities and individual plant species. Large scale infrared photography was also used to estimate mule deer deaths and population density of northern pocket gophers. Author

N74-18040* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REMOTE SENSING IN AGRICULTURE

Sanford W. Downs, Jr. 12 Feb. 1974 30 p refs Original contains color illustrations

(NASA-TM-X-64803) Avail: NTIS HC \$4.50 CSCL 08F

Some examples are presented of the use of remote sensing in cultivated crops, forestry, and range management. Areas of concern include: the determination of crop areas and types, prediction of yield, and detection of disease; the determination of forest areas and types, timber volume estimation, detection of insect and disease attack, and forest fires; and the determination of range conditions and inventory, and livestock inventory. Articles in the literature are summarized and specific examples of work being performed at the Marshall Space Flight Center are given. Primarily, aerial photographs and photo-like ERTS images are considered. Author

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N74-18959*# South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Mar. 1974

Victor I. Myers, Principal Investigator 1 Mar. 1974 2 p EREP

(Contract NAS9-13337)

(E74-10350; NASA-CR-137035) Avail: NTIS HC \$4.00 CSCL 08F

N74-18961*# Department of Agriculture, Washington, D.C. Research and Development Branch.

CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Dec. 1973 - 19 Feb. 1974

Donald H. VonSteen, Principal Investigator 19 Feb. 1974 9 p ERTS

(NASA Order S-70251-AG-3)

(E74-10352; NASA-CR-137037) Avail: NTIS HC \$4.00 CSCL 02C

N74-18971*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL. EXTRACTION OF AGRICULTURAL STATISTICS FROM ERTS-1 DATA OF KANSAS Final Report, 1 Aug. 1972 - 12 Feb. 1974

S. A. Morain, Principal Investigator and Donald L. Williams 12 Feb. 1974 61 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21822)

(E74-10362; NASA-CR-137047) Avail: NTIS HC \$6.25 CSCL 08F

The author has identified the following significant results. Wheat area, yield, and production statistics as derived from satellite image analysis, combined with a weather model, are presented for a ten county area in southwest Kansas. The data (representing the 1972-73 crop year) are compared for accuracy against both the USDA August estimate and its final (official) tabulation. The area estimates from imagery for both dryland and irrigated winter wheat were within 5% of the official figures for the same area, and predated them by almost one year. Yield on dryland wheat was estimated by the Thompson weather model to within 0.1% of the observed yield. A combined irrigated and dryland wheat production estimate for the ten county area was completed in July, 1973 and was within 1% of the production reported by USDA in February, 1974.

N74-18973*# Michigan State Univ., East Lansing.

INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Feb. 1974

Lester V. Manderscheid, Principal Investigator Feb. 1974 3 p EREP

(Contract NAS9-13332)

(E74-10364; NASA-CR-137051) Avail: NTIS HC \$4.00 CSCL 05B

N74-18976*# Iowa State Univ. of Science and Technology, Ames. Agriculture Experiment Station.

REMOTE SENSING IN IOWA AGRICULTURE: IDENTIFICATION AND CLASSIFICATION OF IOWA'S CROPS, SOILS AND FORESTRY RESOURCES USING ERTS-1 AND

COMPLIMENTARY UNDERFLIGHT IMAGERY Progress Report, period ending Feb. 1974

J. P. Mahlstede, Principal Investigator, R. E. Carlson, T. E. Fenton, and G. W. Thomson 28 Feb. 1974 22 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21839)

(E74-10367; NASA-CR-137061) Avail: NTIS HC \$4.25 CSCL 08F

The author has identified the following significant results. Springtime ERTS-1 imagery covering pre-selected test sites in Iowa showed considerable detail with respect to broad soil and land use patterns. Additional imagery has been incorporated into a state mosaic. The mosaic was used as a base for soil association lines transferred from an existing map. The regions of greatest contrast are between the Clarion-Nicollet-Webster soil association area and adjacent areas. Landscape characteristics in this area result in land use patterns with a high percentage of pasture, hay, and timber. The soil association areas of the state that have patterns interpreted to be associated with intensive row crop production are: Moody, Galva-Primghar-Sac, Clarion-Nicollet-Webster, Tama-Muscatine, Dinsdale-Tama, Cresco-Lourdes, Clyde, Kenyon-Floyd-Clyde, and the Luton-Onawa-Salix area on the Missouri River floodplain. Forestland estimates have been attained for an area in central Iowa using wintertime ERTS-1 imagery. Visual analysis of multispectral, temporal imagery indicates that temporal analysis for cropland identification and acreage analyses procedures may be a very useful tool. Combinations of wintertime, springtime, and summertime ERTS-1 imagery separate most vegetation types. Timing can be critical depending upon crop development and harvesting times because of the dynamic nature of agricultural production.

N74-18979*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 16 Jan. - 15 Mar. 1974

Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 15 Mar. 1974 8 p ref ERTS

(NASA Order T-4106-B)

(E74-10370; NASA-CR-137067; MPR-10) Avail: NTIS HC \$4.00 CSCL 02F

N74-18988*# Geological Survey, Tucson, Ariz.

DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID-LAND PLANT COMMUNITIES Progress Report, 1 Jul. - 31 Aug. 1973

Raymond M. Turner, Principal Investigator 12 Feb. 1974 2 p ERTS

(NASA Order S-70243-AG-2)

(E74-10379; NASA-CR-137164) Avail: NTIS HC \$4.00 CSCL 08F

N74-18993*# Geological Survey, Tucson, Ariz.

DYNAMICS OF DISTRIBUTION AND DENSITY OF PHREATOPHYTES AND OTHER ARID-LAND PLANT COMMUNITIES Progress Report, 1 Sep. - 30 Oct. 1973

Raymond M. Turner, Principal Investigator 12 Feb. 1974 2 p ERTS

(NASA Order S-70243-AG-2)

(E74-10384; NASA-CR-137169) Avail: NTIS HC \$4.00 CSCL 08F

N74-18997*# South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Dec. 1973

Victor I. Myers, Principal Investigator 1 Dec. 1973 2 p EREP

(Contract NAS9-13337)

(E74-10388; NASA-CR-137206) Avail: NTIS HC \$4.00 CSCL 08F

N74-19002*# Michigan State Univ., East Lansing.

USE OF ERTS DATA FOR A MULTIDISCIPLINARY ANALYSIS OF MICHIGAN RESOURCES Progress Report

Axel L. Andersen, Wayne Myers, Gene Safir, and E. P. Whiteside, Principal Investigators 21 Mar. 1974 20 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21834)

(E74-10393; NASA-CR-137211; PR-3) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. The results of this investigation of ratioing simulated ERTS spectral bands and several non-ERTS bands (all collected by an airborne multispectral scanner) indicate that significant terrain information is available from band-ratio images. Ratio images, which are based on the relative spectral changes which occur from one band to another, are useful for enhancing differences and aiding the image interpreter in identifying and mapping the distribution of such terrain elements as seedling crops, all bare soil, organic soil, mineral soil, forest and woodlots, and marsh areas. In addition, the ratio technique may be useful for computer processing to obtain recognition images of large areas at lower costs than with statistical decision rules. The results of this study of ratio processing of aircraft MSS data will be useful for future processing and evaluation of ERTS-1 data for soil and landform studies. Additionally, the results of ratioing spectral bands other than those currently collected by ERTS-1 suggests that some other bands (particularly a thermal band) would be useful in future satellites.

N74-19013*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

MULTISTAGE, MULTIBAND AND SEQUENTIAL IMAGERY TO IDENTIFY AND QUANTIFY NON-FOREST VEGETATION RESOURCES Remote Sensing Applications in Forestry. Final Report

Richard S. Driscoll and Richard C. Francis Berkeley, Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1972 59 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab.

(NASA Order R-09-038-002)

(NASA-CR-137147) Avail: NTIS HC \$6.00 CSCL 08F

Earth Resources photographs from Apollo 6, 7, and 9 and photographs taken during Gemini 4, were used in the research along with high altitude and conventional aerial photography. A unified land use and resource analysis system was devised and used to develop a mapping legend. The natural vegetation, land use, macrorelief, and landforms of northern Maricopa County, Arizona, were analyzed and inventoried. This inventory was interpreted in relation to the critical problem of urban expansion and agricultural production in the study area. The central thrust of the research program has been to develop methods for use of space and small-scale, high-altitude aerial photography to develop information for land use planning and resource allocation decisions. Author

N74-19031# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

COMPARISON OF SOIL SURFACE TEMPERATURE

MEASUREMENTS BY MEANS OF STANDARD SOIL MERCURY THERMOMETERS AND A BARNES PRT-5 INFRARED THERMOMETER

D. T. Anderson Nov. 1972 25 p refs

(INPE-268-RI/058) Avail: NTIS HC \$4.25

A short account is given of the difficulties encountered in temperature measurement of boundary layers and a comparison

N74-19940*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. 02f

INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jan. - 28 Feb. 1974

Robert C. Heller, Robert C. Aldrich, Richard S. Driscoll, and F. P. Weber, Principal Investigators 20 Mar. 1974 14 p ERTS (NASA Order S-70251-AG)

(E74-10404; NASA-CR-137232; FS-1-7) Avail: NTIS HC \$4.00

The author has identified the following significant results. Controlled visual interpretation of one ERTS-1 scene taken at the peak of the growing season has indicated that classification to the ECOCLASS Series level is not entirely satisfactory. For five forest classes, aspen, Douglas-fir, lodgepole pine, ponderosa pine, and Spruce/fir, correct identification ranged from 60 to 70 percent. With the exception of shortgrass and wet shrubby meadow classes in the nonforest categories (81 and 100 percent correct, respectively), correct identification of the nonforest classes is so far unacceptable. The low accuracies are believed due to: (1) edge effects due to ecotones between plant community classes with apparent similar image characteristics; (2) confounding effects of amount of plant crown cover and ground surface material in the scene; and (3) variable land slope degree and aspect as it affects the image signature.

N74-19943*# Cornell Univ., Ithaca, N.Y. Div. of Atmospheric Sciences.

PHENOLOGY SATELLITE EXPERIMENT Progress Report, Aug. 1973 - Feb. 1974

Bernard E. Dethier, Principal Investigator, Marshall D. Ashley (Maine Univ.), Byron O. Blair (Purdue Univ.), Joseph M. Caprio (Montana State Univ.), Richard J. Hopp (Vermont Univ.), and John W. Rouse, Jr. (Texas A&M Univ.) 15 Mar. 1974 32 p refs ERTS

(Contract NAS5-21781)

(E74-10407; NASA-CR-137253) Avail: NTIS HC \$4.75 CSCL 08F

N74-19949*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.

APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Jan. - 28 Feb. 1974

Harvey K. Nelson, Principal Investigator 1 Mar. 1974 3 p ERTS

(NASA Order S-70243-AG-4)

(E74-10414; NASA-CR-137273) Avail: NTIS HC \$4.00 CSCL 06C

N74-19959*# Alabama A & M Univ., Normal. Dept. of Natural Resources.

APPLICATION OF REMOTE SENSING IN AGRICULTURE AND FORESTRY AND GROUND TRUTH DOCUMENTATION IN RESOURCE PLANNING Final Technical Report, May 1971 - May 1974

4 Jan. 1974 7 p

(Grant NGR-01-001-014)

(NASA-CR-138028) Avail: NTIS HC \$4.00 CSCL 08B

Varied small scale imagery was used for detecting and assessing damage by the southern pine beetle. The usefulness of ERTS scanner imagery for vegetation classification and pine beetle damage detection and assessment is evaluated. Ground truth acquisition for forest identification using multispectral aerial photographs is reviewed. J.A.M.

01 AGRICULTURE AND FORESTRY

N74-20976*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT: WATERFOWL HABITAT MANAGEMENT AT POINTE MOUILLEE Technical Report, 1 Jun. 1972 - 31 Dec. 1974

A. N. Sellman, I. J. Sattinger, L. B. Istvan, W. R. Enslin, W. L. Myers, and M. C. Sullivan Apr. 1974 45 p refs Prepared in cooperation with Michigan State Univ. and Mich. Dept. of Natural Resources Original contains color illustrations

(Grants NGR-23-005-552; NGL-23-004-083)

(NASA-CR-137430; ERIM-193400-1-T) Avail: NTIS HC \$5.25 CSCL 08B

For many years the Pointe Mouillee State Game Area, located on the Lake Erie shoreline just south of Detroit, has been a prime waterfowl habitat. The usefulness of the site for this purpose has been impaired because of the gradual deterioration of the marshland and severe flooding and storms during the spring of 1973. Also, it has been proposed that a dredge spoils area be located in or near the marsh. To aid the future management of a diked refuge area of 148 hectares within the State Game Area, a detailed vegetation inventory was prepared by photointerpretation and a generalized vegetation inventory was obtained by processing multispectral scanner imagery. Also, an analysis was conducted to determine the magnitude of past losses of marshland and the possibilities of replacing this lost habitat. The analysis indicated that large additions to waterfowl habitat could be provided by changes in management of vegetation in existing sections of the State Game Area, through acquisition and conversion of adjacent land by the Michigan Department of Natural Resources, and by the proposed construction of a barrier dike offshore of Pointe Mouillee. Altogether, the various measures considered in this report could affect a total area of nearly 13 sq. km.

Author

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A74-19310 NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1 - Technical papers. Part 2 - Signal processing. Part 3 - Infrared. Meeting sponsored by the Institute of Electrical and Electronics Engineers, Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973. Pt. 1, 238 p.; pt. 2, 224 p.; pt. 3, 148 p. Price of each part, \$20.

Remote monitoring of the atmosphere with Raman lidar, measurement of subsurface seawater properties using airborne lasers, and long-path monitoring with tunable gas lasers are among the topics covered in papers concerned with the characteristics of active environmental sensing. Other areas covered include water and waste-water control and monitoring, automated and semiautomated assembly and testing, and emerging product technologies using MOS/LSI. Discussed signal processing technologies include digital, electronic-analog, and optical techniques. Infrared technology is also considered.

M.V.E.

A74-21005 Optical detection and identification of monolayers on water substrates. W. C. Curtis (Advanced Scientific Laboratories, Washington, D.C.). In: *Electro-Optical Systems Design Conference*, 5th, New York, N.Y., September 18-20, 1973, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1973, p. 335-341. 20 refs.

It is shown that the presence of monolayers on liquid surfaces is definitely detectable under laboratory conditions by means of a simple ellipsometer of experimental design. Insight into the characteristic transient and steady state behavior of monolayers can also be obtained by this simple means.

M.V.E.

A74-21461 * A comparative analysis of remote sensing scale/system attributes for a multi-level land use classification system. G. K. Higgs and M. Sullivan (Michigan State University, East Lansing, Mich.). In: *American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1.* Falls Church, Va., American Society of Photogrammetry, 1973, p. 335-367. 9 refs. Grant No. NGL-23-004-083.

A74-21462 Correction of remote sensing photographs for particulate air pollution effects. W. T. Davis, K. E. Noll, and W. B. Hickam (Tennessee, University, Knoxville, Tenn.). In: *American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1.* Falls Church, Va., American Society of Photogrammetry, 1973, p. 384-407. 11 refs.

The fundamental equations necessary for developing the required theoretical relationships are the Bouguer-Lambert law and the basic definition of photographic density. The experimental verification of the theoretical equation for predicting the scattering coefficient is discussed together with the verification of the equation for the prediction of initial ground target density. An analysis of the experimental data suggests that the relationship developed can quantitatively account for sky-light, diffuse light, and scattered light effects produced by particulate air pollution.

G.R.

A74-21466 Detecting and monitoring oil slicks with aerial photography. K. N. Vizi (Eastman Kodak Research Laboratories, Rochester, N.Y.). In: *American Society of Photogrammetry, Fall*

Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 437-464. 44 refs.

A74-21484 * Aerial and satellite photography - A valuable tool for water quality investigations. J. P. Scherz, J. F. Van Domelen, and S. A. Klooster (Wisconsin, University, Madison, Wis.). In: *American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2.* Falls Church, Va., American Society of Photogrammetry, 1973, p. 883-905. 16 refs. Grant No. NGL-50-002-127.

An investigation of surface, volume, and bottom effects in Lake Superior is conducted. The objective of the reported study is the development of a reliable technique for the monitoring and the quantification of the water quality parameters associated with volume reflectance. Basic relationships are discussed together with details concerning the equipment used in the studies, the water quality on the basis of aerial photos and satellite imagery, and the effects of oil on sky-light reflection.

G.R.

A74-21485 * The use of near-infrared photography for biodegradable pollution monitoring of tidal rivers. W. E. Bressette (NASA, Langley Research Center, Hampton, Va.) and D. E. Lear, Jr. (U.S. Environmental Protection Agency, Annapolis Field Office, Annapolis, Md.). In: *American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2.* Falls Church, Va., American Society of Photogrammetry, 1973, p. 906-925. 10 refs.

On October 2, 1972, a pattern of chlorophyll a containing phytoplankton (algae) was detected from 3-km altitude in a series of near-infrared photographs of the Potomac River 'Salt Wedge Area.' Densitometer traces over the film images, related to in situ measurements of chlorophyll a concentrations that varied from 4 to more than 3000 micrograms/liter, revealed a phytoplankton 'bloom' threshold in the near infrared between the concentration of 34 and 51 micrograms/liter. The photography also revealed bottom features through two meters of water and made it possible to integrate chlorophyll a concentrations over a 16 sq km area to demonstrate this remote sensing technique for biodegradable pollution monitoring.

(Author)

A74-21573 Applications of tunable dye lasers to air pollution detection - Measurements of atmospheric NO₂ concentrations by differential absorption. K. W. Rothe, U. Brinkmann, and H. Walther (Köln, Universität, Cologne, West Germany). *Applied Physics*, vol. 3, Feb. 1974, p. 115-119. 12 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A74-22190 # An assessment of ERTS 1 imagery as an aid in land resource planning. M. A. Keech, C. Bully, I. Corker, M. Dirkswager, K. MacKenzie, R. Rowbotham, and J. Stanning (National College of Agricultural Engineering, Silsoe, Beds., England). (*British Interplanetary Society, Symposium on Earth Observation Satellites, University College, London, England, Apr. 10-12, 1973.*) *British Interplanetary Society, Journal*, vol. 27, Mar. 1974, p. 173-176.

Providing all Multi-Spectral Scanner bands are used, an accurate general view of an area can be obtained without the use of sophisticated technical equipment. Major recurrent landscape patterns can be defined, but the land facets making them up cannot. Land use maps can be prepared at a medium scale, and some vegetation complexes can be defined. A most valuable feature is the monitoring facility it offers. To get the fullest value from the imagery however does require training personnel in its effective use.

(Author)

A74-22804 Remote sensing by satellite - Applications to the Alaskan environment and resources. A. E. Belon and J. M. Miller (Alaska, University, Fairbanks, Alaska). In: *University of Alaska, Geophysical Institute, Annual Report 1972-73.* Fairbanks, University

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of Alaska, 1973. 22 p.

The University of Alaska ERTS-1 program which incorporates twelve projects covering ten disciplines, and involving eight research institutes and academic departments, is discussed. The way in which remote sensing by satellite is narrowing the knowledge gap on the vast and varied arctic environment is described and demonstrated by examples. V.P.

A74-23715 **Air pollution field studies with a Raman Lidar.** H. P. DeLong (U.S. Army, Defense Systems Div., Aberdeen Proving Ground, Md.). *Optical Engineering*, vol. 13, Jan.-Feb. 1974, p. 5-9. 15 refs.

Raman Lidar techniques have been discussed theoretically and sensitivities for various pollutants have been predicted. The results of the present real Raman Lidar indicates pollutant levels between 40-700 ppm is the present sensitivity but very realistic projections based on this data suggest sensitivities between 0.4-7 ppm could be reached if nondispersive detection techniques were used. (Author)

A74-23717 **Long path infrared spectroscopic detection of atmospheric pollutants.** T. B. Hirschfeld (Block Engineering, Inc., Cambridge, Mass.). *Optical Engineering*, vol. 13, Jan.-Feb. 1974, p. 15-18. 7 refs.

Long path infrared spectroscopy of air pollutants is operationally classified into several system types: long folded path samplers, two station remote instruments using either a remote source or a remote retroreflector, and one station remote instruments using either natural sources, laser backscatter, remote fluorescence, or passive measurement of sample thermal emission. The operational requirements of each system are described, as are their advantages, disadvantages, and one example each of their results. A comparison of their overall performance reveals that the best system now available would be a two station remote device with an array of distal retroreflectors, employing a correlation Fourier Transform Spectrometer as a receiver. The main application of such a system would be the detection of widely dispersed pollutants at extremely low concentrations. (Author)

A74-24321 # **Environmental studies from piloted orbital bases (Issledovaniia prirodnoi sredy s pilotiruemykh orbital'nykh stantsii).** G. T. Beregovoi, A. A. Buznikov, O. B. Vasil'ev, B. V. Vinogradov, V. N. Volkov, G. B. Gonin, K. Ia. Kondrat'ev, O. N. Lebedev, A. G. Nikolaev, and V. I. Sevastianov. Leningrad, Gidrometeoizdat, 1972. 411 p. 237 refs. In Russian.

The results of environmental studies carried out on board Soviet manned orbital spacecraft are analyzed and generalized. Much attention is given to cosmonaut observations of optical phenomena occurring in the atmosphere, such as observations of daytime, twilight, and nighttime horizons, which have lead to the discovery of the vertical ray structure of the daytime emission of the upper atmosphere. The interpretation of photographs of the earth with regard to geology, morphology, botany, pedology, hydrology, and similar sciences is discussed. The application of spectrophotometry to the study of twilight aureole spectra and the identification of natural formations from their reflection spectra is treated in some detail. V.P.

A74-24445 # **Application of lasers to air pollution measurements.** K. W. Rothe, U. Brinkmann, and H. Walther (Köln, Universität, Cologne, West Germany). In: The physics of electronic and atomic collisions; International Conference, 8th, Belgrade, Yugoslavia, July 16-21, 1973, Invited Lectures and Progress Reports. Belgrade, Institut za Fiziku, 1973, p. 703-718. 33 refs.

Recent investigations of molecular and atomic properties of the atmosphere, performed by means of Raman and resonance scattering methods using LIDAR techniques, are reported. Following a brief review of the underlying theory, obtained measurement results are presented. The significance of these results is discussed. M.V.E.

A74-25105 **Remote sensing: Techniques for environmental analysis.** Edited by J. E. Estes (California, University, Santa Barbara, Calif.) and L. W. Senger (Dames and Moore, Santa Barbara, Calif.). Santa Barbara, Calif., Hamilton Publishing Co., 1974. 340 p. \$11.50.

Qualitative data extraction and analysis of remote sensor images, imaging with photographic and nonphotographic sensor systems, and geomorphic-geologic mapping from data obtained by remote sensors are among the topics covered in papers concerned with techniques for environmental analysis. Other topics covered include interpretation and mapping of natural vegetation, remote sensing of agricultural resources, and urban applications of remote sensing. M.V.E.

A74-25112 **Interpreting, land use from, remote sensor imagery.** N. R. Nunnally (Oklahoma, University, Norman, Okla.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 167-187. 145 refs.

Remote sensing research is reviewed, with special attention to the approaches used and problems encountered in such investigations. Inventories, thematic land-use mapping, land-use system and landscape approaches, and detection of changes in land use are among the discussed applications of remote sensing. Classification and interpretation problems, encountered in the extraction of land-use data from imagery, are examined. M.V.E.

A74-25114 **Urban applications of remote sensing.** D. T. Lindgren (Dartmouth College, Hanover, N.H.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 225-241. 39 refs.

Specific applications of remote sensing to the urban environment are discussed. Reviewed application objectives include: (1) urban land-use mapping, (2) transportation studies, (3) special engineering projects; (4) municipal inspection; (5) dwelling-unit and population estimation; and (6) housing-quality studies. The merits and development status of nonphotographic sensing techniques, such as radar and thermal infrared, are outlined. It is shown that remote sensing should play an important role in any urban information system. It may provide an important supplement to present, often inefficient data-collection procedures. M.V.E.

A74-25115 **Remote sensing techniques and urban data acquisition - Selected examples.** F. E. Horton (Iowa, University, Iowa City, Iowa). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 243-275. 117 refs.

The relationship between remote sensing data and the requirements of urban information systems is examined. A theoretical and research-oriented discussion is presented about urban data needs, urban-change detection systems, housing quality, population estimation, and land use. Remote sensing is shown to offer a unique capability to provide data about many important aspects of urban growth and change. Some of the application-technique improvements and adjustments are pointed out that must be accomplished before all of the cost-effective applications of remote sensing as an urban data acquisition device can be identified. M.V.E.

A74-25116 **Regional analysis and remote sensing - A methodological approach.** R. W. Peplies (East Tennessee State University, Johnson City, Tenn.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 277-291. 27 refs.

Philosophical discussion of the significance of the regional concept, and review of the needs and aims of regional analysis. The possibilities provided by remote sensing for regional analyses are examined. It is shown that remotely sensed data can provide most of the information needed for examining the component parts of a defined region. M.V.E.

A74-25117 Remote sensing of environmental quality - Problems and potential. H. Aschmann and L. W. Bowden (California, University, Riverside, Calif.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 293-301. 11 refs.

The problems in determining objective indices of environmental degradation are discussed. In environmental studies, remote sensing may have two distinctive contributions to make: (1) providing a full distributional inventory of areas of atmospheric and water pollution; and (2) determining the regional, national, or worldwide burden of pollutants that air and land are being forced to bear. P.T.H.

A74-25391 * Remote sensing - A new view for public health. D. R. Morrison, C. M. Barnes (NASA, Johnson Space Center, Houston, Tex.), and C. E. Fuller (NASA, Johnson Space Center, Houston, Tex.; USAF, Health Applications Office, Washington, D.C.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 99-106. 5 refs.

It is shown that the technology of remote sensing can be of great importance to the field of public health. This possibility is based on the deepened understanding of the biologies and ecologies of the vector/organism/host interrelationships of arthropod-, soil-, and water-borne diseases to result from the information that remote sensing can provide. M.V.E.

A74-25393 * Development of flight experiments for remote measurement of pollution. L. S. Keafer, Jr. and L. P. Kopia (NASA, Langley Research Center, Hampton, Va.). In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 129-163. 17 refs. NASA-sponsored research.

The status as of February 1973 of several NASA-sponsored development projects is reported concerning flight experiments for remote measurement of pollution. Eight passive multispectral instruments for remotely sensing air and water pollutants are described, as well as two active (laser radar) measuring techniques. These techniques are expected to add some new dimensions to the remote sensing of water quality, oceanographic parameters, and earth resources. Multiple applications in these fields are generally possible. Successful completion of the flight demonstration tests and comparisons with simultaneously obtained surface truth measurements may establish these techniques as valid water quality monitoring tools. M.V.E.

A74-25395 Application of remote sensing to leisure resource planning and management. D. R. Dunn (Temple University, Philadelphia, Pa.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 189-199. 16 refs.

A74-25397 Detection of urban blight using remote sensing techniques. A. J. Tuyahov, S. Davies, and R. K. Holz (Texas, University, Austin, Tex.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 213-226. 5 refs.

Remote sensing methodology was demonstrated as an accurate and effective method of determining urban blight in Austin, Tex. Various levels of housing and environmental quality were assessed and mapped utilizing conventional black and white and color-infrared photography. The evaluation resulted in the identification of 18 indicators or image signatures of different socio-economic class. Using census tract data, a factor analysis was then applied to verify

the delimitation of socio-economic classes as accomplished by remote sensing. The spatial distribution of different class neighborhoods showed consistency of results between the remote sensing and factor analysis methods. Ground surveys were used to further substantiate the findings of the remote sensing method. (Author)

A74-25402 Regional resource surveys in Latin America. K. B. Craib (Resources Development Associates, Los Altos, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 289-298. 7 refs.

A74-25403 Project RADAM - Remote sensing application to environmental analysis of Amazon region. H. F. Moreira (Ministry of Mines and Energy, National Department of Mineral Production, Brazil). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 299-304. Research supported by the Ministry of Mines and Energy of Brazil. Project RADAM.

A74-25406 * Progress in the application of higher specificity laser induced luminescence to the remote sensing of the environment and resources. H. G. Gross (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 345-361. 10 refs. Research supported by the McDonnell Douglas Astronautics Independent Research and Development Funds; Contracts No. NAS9-7966; No. NAS9-11679.

A74-25445 * Geographic applications of ERTS-I imagery to rural landscape change in eastern Tennessee. J. B. Rehder (Tennessee, University, Knoxville, Tenn.) and J. R. O'Malley. In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1005-1009. Contract No. NAS5-21726.

A74-25453 Applied remote sensing of water pollution. C. E. Lundquist (Altair Remote Sensing, S.A., Lucerne, Switzerland). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1121-1135.

For effective management of water resources there is an urgent need for reliable synoptic information of the water conditions in whole aquatic systems. This paper deals with an aerial continuous strip multiband photographic system that provides new, often unique advantages for acquisition and processing of data having significance in water pollution control. By use of narrower spectral bands, as low as about 1 nanometer, than heretofore possible in conventional multispectral photography, detection and measurement of dissolved and suspended substances can be accomplished both quantitatively and qualitatively. In order to present the system in a concise form, this contribution treats the matter practically and is not burdened with exhaustive theoretical proof. (Author)

A74-25457 Water quality determination by photographic analysis. S. A. Klooster and J. P. Scherz (Wisconsin, University, Madison, Wis.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi,

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University of Tennessee, 1973, p. 1187-1200. 9 refs.

The combination of field data and a laboratory analysis of paper mill wastes has led to a positive correlation between optical densities on film and turbidity in water. The turbidity can be correlated with total suspended solids if the constituent parts of the effluent remain the same and the volumetric flow remains relatively constant. The described technique requires the use of a monochromator for the selection of the bandwidths containing the most information. T.M.

A74-25459 * The use of aerial photography to quantitatively delineate mixing zones - A progress report. T. M. Lillesand (Wisconsin, University, Madison, Wis.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1251-1268. 16 refs. Grant No. NGL-50-002-127.

Aerial photography has been used to characterize and model the mixing zones which result from waste effluent discharges at seven river sites throughout the state of Wisconsin. The mixing zone is defined as the portion of the river where the waste effluent is totally mixed with the ambient receiving water. An integrated program of field sampling, mathematical modeling, laboratory modeling, and remote sensing was conducted to develop a quantitative relationship for the volumetric configuration of the mixing zone as a function of the measurable characteristics of various effluents, outfalls, and receiving water bodies. Analysis of scanning microdensitometer data extracted from 9-in. color IR transparencies has confirmed the utility of employing image density measurements to quantitatively delineate surficial concentration patterns within the mixing zone. T.M.

A74-25912 Airborne surveys of terrestrial gamma radiation in environmental research. Z. G. Burson (EG & G, Inc., Las Vegas, Nev.). (IEEE, NASA, and AEC, Nuclear Science Symposium, 20th, San Francisco, Calif., Nov. 14-16, 1973.) IEEE Transactions on Nuclear Science, vol. NS-21, Feb. 1974, p. 558-571. 60 refs. AEC-sponsored research.

Aerial surveys of terrestrial gamma radiation have many applications. These include (1) mineral exploration, (2) nuclear facilities environmental monitoring, (3) water equivalent of snow cover determinations, and (4) soil moisture estimates. The latter two applications are not yet operational in the United States, although snow surveys have been conducted in the USSR for many years. The primary detectors for all applications is the NaI(Tl) crystal. Single and multiple arrays are flown in a variety of aircraft (including helicopters) at altitudes varying from 25 to 150 m. Accuracy of results appear adequate for most applications. Accuracies can be improved by better accounting for the background components, particularly airborne radioactivity. (Author)

A74-26182 Low-cost computerized land-use classification. J. D. Turinetti and O. W. Mintzer (USAF, Griffiss AFB, N.Y.). Photogrammetric Engineering, vol. 40, Apr. 1974, p. 479-488. 9 refs.

Investigation of a low-cost computerized analysis approach designed to identify general land-use classifications from a number of multiformat, nonregistered, multispectral images. Sample targets of known land-use classes were used as models for identification. The more accurately the evaluation model approximated the actual land uses displayed on the imagery, the better the target identification. M.V.E.

A74-26893 Raman spectroscopy as a water quality indicator. A. Davis (Department of the Environment, Ottawa, Canada), M. Bristow (Department of Energy, Mines and Resources, Ottawa, Canada), and J. Koningstein (Carleton University, Ottawa, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 239-246.

A study of the effectiveness of Raman spectroscopy in water

quality analysis by remote sensing techniques indicates a good potential of Raman spectroscopy in such applications. A laser assembly using resonance Raman spectroscopy in remote water quality control experiments is described. Some experimental data are included. V.Z.

A74-26896 Use of thermal infrared scanning in evaluating predictive models for power plant thermal plume mixing in Italian coastal waters. G. Dinelli, F. Parrini (Ente Nazionale per l'Energia Elettrica, Milan, Italy), and D. T. Hodder (Rockwell International Corp., Downey, Calif.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 270-283.

The analysis of the dispersal of thermal plumes of cooling water discharged by power plants has been resolved into three phases. Theoretical and laboratory studies have been developed to describe all three of these phases. However, their practical application is limited by the time varying complexity of the natural water environment, and the difficulty and expense of making the necessary physical measurements to correctly apply the available, essentially steady-state models. This study attempts to resolve these difficulties by using thermal (8-14 micron) infrared scanning to obtain repetitive coverage of a number of power plant sites in Italy. These sites represent a wide range of environmental and discharge conditions. The infrared images were directly interpreted together with surface isothermal maps (0.5 C contour intervals) prepared from the IR imagery mosaics. This analysis permitted the recognition of the instantaneous prevalence of the various phases of mixing and identification at each site and their aerial extent. (Author)

A74-26900 Water pollution surveillance using local remote sensing equipment. W. B. McCoy and T. H. Lackie (Saskatchewan, University, Saskatoon, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 325-330. 5 refs.

Supplementary aerial photography has proved to be a useful tool in surveillance of water pollution. This is especially true in areas that are remote from the home base of governmental and commercial agencies offering services in this field. Techniques for securing imagery are well established, and use of locally available light aircraft, adapted to serve as platforms for vertical photography, has proved to be technically and economically feasible. The 70 mm Hasselblad cameras set on specially designed mounts have provided excellent vertical imagery (including capability for multispectral work); and this technique has been supplemented by use of miniature 35 mm cameras for oblique photography. When adequate techniques for quantitative interpretation of air photos are available they will significantly increase the value of this method of water pollution surveillance. (Author)

A74-26902 Spectral reflectance of water containing suspended sediment. B. J. Blanchard (U.S. Department of Agriculture, Agricultural Research Service, Chickasha, Okla.) and R. W. Leamer (U. S. Department of Agriculture, Agricultural Research Service, Weslaco, Tex.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 339-347. 6 refs.

A spectral radiometer, measuring radiation in the visible and near-infrared portion of the spectrum, was used to examine (1) different concentrations of red, black, and gray clay particles in water, and (2) several samples of natural pond water containing sediment. Four of the pond samples had algae present. Reflectance curves in the near-infrared region show very little change caused by changing sediment concentrations. However, reflectance curves in the visible portion of the spectrum are sensitive to very low concentrations (less than 200 ppm suspended solids) of sediment with similar characteristics. The samples containing algae showed a good possibility of detecting algae by ratioing the reflectance near wavelength 570

nm with the reflectance at 680 nm. Response at 570 nm appears to be related to the suspended sediment. Results using film density measurements also show promise for use in estimating low sediment concentration. (Author)

A74-26904 * Remote sensing in the mixing zone. J. R. Villemonte, J. A. Hoopes, D. S. Wu, and T. M. Lillesand (Wisconsin, University, Madison, Wis.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 368-386. 5 refs. Research supported by the Department of Natural Resources of the State of Wisconsin and NASA.

Results to date of a study of the dispersion and diffusion mechanisms by which pollutants are transported in natural river courses. The mixing zone at several industrial sites was studied by both ground and remote sensing methods. The advantage of coordination of these two methods is highlighted. The results can be used in the establishment of definite and rational water quality guidelines and in the development of a sampling and surveillance program by governmental and private agencies. P.T.H.

A74-26908 * Application of selected methods of remote sensing for detecting carbonaceous water pollution. E. M. Davis and W. J. Fosbury (Texas, University, Houston, Tex.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 419-432. Contract No. NAS9-12040.

A reach of the Houston Ship Channel was investigated during three separate overflights correlated with ground truth sampling on the Channel. Samples were analyzed for such conventional parameters as biochemical oxygen demand, chemical oxygen demand, total organic carbon, total inorganic carbon, turbidity, chlorophyll, pH, temperature, dissolved oxygen, and light penetration. Infrared analyses conducted on each sample included reflectance ATR analysis, carbon tetrachloride extraction of organics and subsequent scanning, and KBr evaporate analysis of CCl₄ extract concentrate. Imagery which was correlated with field and laboratory data developed from ground truth sampling included that obtained from aerial KA62 hardware, RC-8 metric camera systems, and the RS-14 infrared scanner. The images were subjected to analysis by three film density gradient interpretation units. Data were then analyzed for correlations between imagery interpretation as derived from the three instruments and laboratory infrared signatures and other pertinent field and laboratory analyses. (Author)

A74-27849 Stratospheric survey aircraft developed. *Aviation Week and Space Technology*, vol. 100, Apr. 15, 1974, p. 62, 63, 65.

A remotely piloted small-scale aircraft under development, intended to fly stratospheric survey missions with a ceiling of up to 100,000 ft, is examined. Termed the Mini-Sniffer, the canard aircraft will have a maximum gross takeoff weight of 145 lb and a payload of 25 lb. The two-stroke hydrazine monopropellant reciprocating engine (driving a variable-diameter propeller) is mounted in the aft pusher position to eliminate interference with the nose-mounted air sampling probes. The main wing is a high-aspect-ratio design with a span of 18 ft, an area of 35.5 sq ft, and a sweep angle of 20 degrees. V.P.

A74-27877 # Meteorological aspects of atmosphere pollution and the possibilities of observations from space (Meteorologicheskie aspekty zagriaznenii atmosfery i vozmozhnosti nabliudenii iz kosmosa). K. Ia. Kondrat'ev and Kh. Iu. Niilisk. In: Radiation studies in the atmosphere. Leningrad, Gidrometeoizdat, 1973, p. 3-23. 74 refs. In Russian.

Studies dealing with atmosphere pollution as a factor influencing the climate are reviewed. Particular attention is given to

the effects of increased carbon dioxide concentrations and aerosol contents on air temperature variations. Sulfur dioxide, carbon monoxide and other industrial air pollutants are covered. Satellite-based methods of air pollution recording, notably the application of emission and absorption spectroscopy, are discussed and their potential is assessed. Lack of information on air pollution on a global scale is believed to handicap studies of the meteorological significance of air pollution. V.Z.

A74-28328 Merits of conventional aerial photography in an intensive natural resources inventory in Puerto Rico. L. H. Liegel (U.S. Forest Service, Institute of Tropical Forestry, Rio Piedras, P.R.) and G. A. del Toro (Puerto Rico Department of Natural Resources, San Juan, P.R.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 178-191. 9 refs.

A74-28334 Mapping land-use from existing air photos. J. M. Walton, C. E. Olson, Jr. (Michigan, University, Ann Arbor, Mich.), and E. Limoges. In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 290-300.

The two most recent, county-wide surveys conducted in Washtenaw County, Michigan, are considered, giving attention to the 1970 survey and the 1973 survey. In 1970, land-use data were gathered with conventional ground survey methods using existing township, city, and village tax-parcel boundary maps as base maps. In 1973, land-use data were extracted from existing aerial photographs. A comparison of the two surveys reveals that the 1970 survey was far more expensive, but provided more detailed information in urban areas, than the 1973 survey. G.R.

A74-28336 * Photographic quantification of water quality in mixing zones. T. M. Lillesand (New York, State University, Syracuse, N.Y.), F. L. Scarpace, and J. L. Clapp (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 333-357. 19 refs. Research supported by the Department of Natural Resources of the State of Wisconsin and Kimberly-Clark Corp.; Grant No. NGL-50-002-127.

The waste effluent mixing zone is defined as the extent of a receiving water body utilized to dilute a waste charge to a concentration characteristic of a totally mixed condition. Color IR photography was used in conjunction with suspended solids water samples to quantitatively delineate the mixing zone resulting from the discharge of a paper mill effluent. Digital scanning microdensitometer data were used to estimate and delineate suspended solids concentrations on the basis of a semiempirical model. Model background, development, and implementation are described. Results indicate that the method is as reliable as conventional surface measuring techniques and is, in fact, more detailed. The method has direct application to the establishment of water quality guidelines, the development of both governmental and private sampling and surveillance programs, and the development of design and location criteria for industrial and municipal waste effluent outfalls. P.T.H.

A74-28340 Automatic digital processing of ERTS-1 MSS data in an urban land-use mapping experiment. R. Ellefsen (California State University, San Jose, Calif.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 405-416. 6 refs.

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N74-16009*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, 1 Jul. - 31 Dec. 1973

Roland S. Yunghans, Principal Investigator, Edward B. Feinberg, Jo Ann Stitt, Robert L. Mairs, Robert T. Macomber, Dennis Stanczuk, and Frank J. Wobber Jan. 1974 56 p refs Prepared for N. J. Dept. of Environ. Protection Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21765)

(E74-10247; NASA-CR-136545) Avail: NTIS HC \$5.00 CSCL 08C

The author has identified the following significant results. The principal thrust of this ERTS-1 experiment is to develop quasi-operational information products from analysis of ERTS-1 imagery and collateral aerial photography and to apply these products to the practical regulation, protection, and management of New Jersey's coastal environment. Incorporated into this goal is the development of procedures for the operational use of ERTS-1 data products within New Jersey's Department of Environmental Protection. Analysis and product preparation for operational needs has centered on four major coastal resource problem areas: detection of land use changes in the coastal zone; siting of ocean outfalls; monitoring of offshore waste disposal; and calculation of recession rates along the Atlantic Shore. The relative utility and estimated monetary benefits derived from ERTS and aircraft imagery for each problem area have been determined. Of equal importance is the development to a capability within the State to use and understand remote sensor-derived information, and the application of this information to meet the requirements of current and anticipated coastal zone legislation.

N74-16013*# Geological Survey, Reston, Va. Geographic Applications Program.

URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report, Nov. 1973

Robert H. Alexander, Principal Investigator and Valerie Milazzo 20 Nov. 1973 4 p refs EREP

(NASA Order T-5290-B)

(E74-10252; NASA-CR-136566) Avail: NTIS HC \$3.00 CSCL 08B

The author has identified the following significant results. Areas of post 1970 and 1972 land use changes were identified solely from the Skylab imagery from comparisons with 1970 land use maps. Most land use changes identified involved transition from agriculture to single family residential land use. The second most prominent changes identified from the Skylab imagery were areas presently under construction. Post 1970 changes from Skylab were compared with the 1972 changes noted from the high altitude photographs. A good correlation existed between the change polygons mapped from Skylab and those mapped from the 1972 high altitude aerial photos. In addition, there were a number of instances where additional built-up land use not noted in the 1972 aerial photo as being developed were identified on the Skylab imagery. While these cases have not been documented by field observation, by correlating these areas with the appearance of similar land use areas whose identity has been determined, we can safely say that we have been able to map further occurrences of land use change beyond existing high altitude photo coverage from the Skylab imagery. It was concluded that Skylab data can be used to detect areas of land use change within an urban setting.

N74-17065*# Environmental Research Inst. of Michigan, Ann Arbor.

STUDY OF RECREATIONAL LAND AND OPEN SPACE

USING SKYLAB IMAGERY Monthly Progress Report, Jan. 1974

Irvin J. Sattinger, Principal Investigator 4 Feb. 1974 3 p EREP

(Contract NAS9-13283)

(E74-10271; NASA-CR-136657; ERIM-103300-18-L) Avail: NTIS HC \$3.00 CSCL 08B

N74-17081*# Alaska Univ., Fairbanks. Geophysical Inst.
FEASIBILITY STUDY FOR LOCATING ARCHAEOLOGICAL VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Progress Report, Jan.-Jul. 1973

John P. Cook, Principal Investigator and W. J. Stringer 30 Jan. 1974 16 p ref ERTS

(Contract NAS5-21833)

(E74-10292; NASA-CR-136679) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. The objective is to determine the feasibility of detecting large Alaskan archaeological sites by satellite remote sensing techniques and mapping such sites. The approach used is to develop digital multispectral signatures of dominant surface features including vegetation, exposed soils and rock, hydrological patterns and known archaeological sites. ERTS-1 scenes are then printed out digitally in a map-like array with a letter reflecting the most appropriate classification representing each pixel. Preliminary signatures were developed and tested. It was determined that there was a need to tighten up the archaeological site signature by developing accurate signatures for all naturally-occurring vegetation and surface conditions in the vicinity of the test area. These second generation signatures have been tested by means of computer printouts and classified tape displays on the University of Alaska CDU-200 and by comparison with aerial photography. It has been concluded that the archaeological signatures now in use are as good as can be developed. Plans are to print out signatures for the entire test area and locate on topographic maps the likely locations of archaeological sites within the test area.

N74-17083*# Alaska Univ., Fairbanks:

FEASIBILITY STUDY FOR LOCATING ARCHAEOLOGICAL VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Bimonthly Progress Report, Aug. - Sep. 1973

John P. Cook, Principal Investigator Sep. 1973 6 p ref ERTS

(Contract NAS5-21833)

(E74-10294; NASA-CR-136681; BMPR-7) Avail: NTIS HC \$3.00 CSCL 08F

N74-17091*# Cornell Univ., Ithaca, N.Y. New York State College of Agriculture and Life Sciences.

EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES Progress Report, 1-31 Jan. 1974

Ernest E. Hardy, Principal Investigator and Deborah Stevens 31 Jan. 1974 11 p EREP

(Contract NAS9-13364)

(E74-10302; NASA-CR-136784) Avail: NTIS HC \$4.00 CSCL 05B

N74-17148# Naval Research Lab., Washington, D.C. Space Sciences Div.

MEASUREMENTS OF THE DISTRIBUTION AND VOLUME OF SEA-SURFACE OIL SPILLS USING MULTIFREQUENCY MICROWAVE RADIOMETRY Interim Report

James P. Hollinger and Robert A. Mennella May 1973 14 p refs

(AD-762753; NRL-7512) Avail: NTIS HC \$3.00 CSCL 13/2

Multifrequency passive microwave measurements from aircraft have been made of eight controlled marine oil spills. It was found that over 90 percent of the oil was generally confined in a compact region with thicknesses in excess of 1 mm and comprising less than 10 percent of the area of visible slick. It is shown that microwave radiometry offers a means to measure the distribution of oil in sea surface slicks and to locate the thick regions and measure their volume on an all-weather, day-or-night, and realtime basis. Author (GRA)

N74-17997*# Wisconsin Univ., Madison. Environmental Monitoring and Data Acquisition Group.

EVALUATION OF THE APPLICATION OF ERTS-1 DATA TO THE REGIONAL LAND USE PLANNING PROCESS Progress Report, period ending 1 Feb. 1974

James L. Clapp, Principal Investigator 1 Feb. 1974 25 p ERTS (Contract NAS5-21754) (E74-10315; NASA-CR-136800) Avail: NTIS HC \$4.25 CSCL 08B

The author has identified the following significant results. Investigators have concentrated on efforts toward assessing the achievements of the current ERTS-1 research so that significant results could be incorporated into the updated version of their ERTS-B research proposal. Significant progress was made in the development of operational mechanisms, linking the research community at the University and the operation agencies of the State of Wisconsin. Efforts have been made to finalize a report which is being prepared for the State of Wisconsin Department of Administration, evaluating the applicability of ERTS-1 to the planning needs of the State of Wisconsin. This document is intended to assess the degree of utility of the satellite for providing information which has been designated by state planners as essential to their needs. This effort is considered highly significant to the overall research program since a situation has been created in which a prime potential user of ERTS type data has been given the opportunity to determine the direction of the research.

N74-18000*# North Carolina State Univ., Raleigh. Dept. of Forestry.

URBAN GREEN SPACE STUDIES WITH ERTS-1 IMAGERY Progress Report, Dec. 1973 - Jan. 1974

Charles W. Welby, Principal Investigator and J. O. Lammi 22 Jan. 1974 2 p ERTS (Contract NAS5-21732) (E74-10322; NASA-CR-136813) Avail: NTIS HC \$4.00 CSCL 08B

N74-18021*# Tennessee Univ., Knoxville. Dept. of Geography.

THE USES OF ERTS-1 IMAGERY IN THE ANALYSIS OF LANDSCAPE CHANGE

John B. Rehder, Principal Investigator 8 Mar. 1974 14 p refs Presented at the 3d Ann. Remote Sensing of Earth Resources Conf., Tullahoma, Tenn., 25-27 Mar. 1974 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-21726) (E74-10346; NASA-CR-136858) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. The analysis of strip mining from ERTS-1 data has resulted in the mapping of landscape changes for the Cumberland Plateau Test Site.

Several mapping experiments utilizing ERTS-1 data have been established for the mapping of state-wide land use regions. The first incorporates 12 frames of ERTS-1 imagery for the generalized thematic mapping of forest cover for the state of Tennessee. In another mapping effort, 14 ERTS-1 images have been analyzed for plowed ground signatures to produce a map of agricultural regions for Tennessee, Kentucky, and the northern portions of Mississippi and Alabama. Generalized urban land use categories and transportation networks have been determined from ERTS-1 imagery for the Knoxville Test Site. Finally, through the analysis of ERTS-1 imagery, short lived phenomena such as the 1973 spring floods on the Mississippi River in western Tennessee, have been detected, monitored, and mapped.

N74-18067*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.

URBAN-FIELD LAND USE FROM RB-57 PHOTOGRAPHY: THE BOSTON AND NEW HAVEN AREAS Final Report

Robert B. Simpson, Robert S. Yuill, and David T. Lindgren Jun. 1972 87 p refs (NASA Order W-13318; Contract DI-14-08-0001-12958) (NASA-CR-137064; USGS-IR-NASA-252; PB-225116/3GA; USGS-DO-73-015) Avail: NTIS HC \$6.50 CSCL 08F

Comparison of information from aerial photography with concurrently derived U.S. Census information for the New Haven area is a follow-on to a prototype effort in the Boston area. Using computer techniques developed in the earlier study, a land use map was created supplemented by tabular printouts of statistical data per land use category. The combined experience suggests that interpretation of photography directly into machine readable form would be desirable and comparison of repetitive coverage would permit meaningful charge detection of urban land use. GRA

N74-18081# Missouri Univ., Kansas City. Dept. of Physics. **INFRARED REFLECTANCE MEASUREMENTS OF MISSOURI WATERS FOR WATER QUALITY APPLICATIONS** Completion Report, 1 Jun. 1972 - 30 Jun. 1973

Richard C. Waring and Marvin R. Querry Aug. 1973 88 p refs (Contract DI-14-31-0001-3825) (PB-225420/9GA; OWRR-A-063-Mo(1)) Avail: NTIS HC \$3.75 CSCL 13B

The desirability of routinely measuring the quality of natural waters has increased with increasing sources of industrial and domestic pollutants. Clearly it would be advantageous to monitor water quality remotely; thus avoiding the time consuming and limited usefulness of hand sampling. Before water quality measurements can be made from data collected remotely from infrared systems the characteristic manner in which solutes in water reflect electromagnetic radiation must be known. In this research project the authors have determined the characteristic way in which some solutes and oil reflect infrared radiation. The research is a part of a larger goal to monitor water quality remotely. GRA

N74-18114# Highway Research Board, Washington, D.C. **PHOTOGRAMMETRIC ANALYSIS OF URBAN AND RURAL ENVIRONMENTS**

1973 71 p refs Presented at 52d Ann. Meeting of the Highway Res. Board, Washington, D. C., Jan. 1973 (PB-224430/9GA; HRB-Record-452; LC-73-15101; ISBN-0-309-02184-7) Avail: NTIS MF \$145; National Academy of Sciences 2101 Constitution Ave., N.W., Washington, D. C. 20418 HC \$2.20 CSCL 13B

The use of photogrammetric analysis to plan and develop highway corridors for recreational areas activities as well as for landscape aesthetics in urban and rural areas is reported. Included in the survey are data on the use of aerial mapping for highway development, aerial survey of highways in North America, remote sensing for environmental analysis, semiautomated large scale mapping, and measuring and depicting trouble areas in stereomodels. E.H.W.

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N74-18116# Naval Research Lab., Washington, D.C.
THE DETERMINATION OF OIL SLICK THICKNESS BY MEANS OF MULTIFREQUENCY PASSIVE MICROWAVE TECHNIQUES Interim Report

James P. Hollinger 15 Jun. 1973 73 p refs
(AD-771376; NRL-7110-1) Avail: NTIS CSCL 13/2

A technique for the remote determination of the thickness and volume of sea surface oil spills using multifrequency microwave radiometry is investigated. Aircraft-borne measurements were made at 19.3 and at 31.0 or 69.8 GHz of eight controlled marine oil spills. The spills consisted of from 200 to 630 gallons of either No. 2 fuel oil or No. 4 or No. 6 crude oil. The slicks always formed an identifiable region with film thicknesses of a millimeter or more and containing the majority of oil which was surrounded by a very much larger and thinner slick which contained very little of the oil. (Modified author abstract) GRA

N74-18817*# Wisconsin Univ., Madison. Inst. for Environmental Studies.

WATER QUALITY DETERMINATION BY PHOTOGRAPHIC ANALYSIS

Steven A. Klooster and James P. Scherz Aug. 1973 16 p refs Submitted for publication
(Grant NGL-50-002-127)
(NASA-CR-137306; Rept-21) Avail: NTIS HC \$4.00 CSCL 07D

Aerial reconnaissance techniques to extract water quality parameters from aerial photos are reported. The turbidity can be correlated with total suspended solids if the constituent parts of the effluent remain the same and the volumetric flow remains relatively constant. A monochromator is used for the selection of the bandwidths containing the most information. White reflectance panels are used to locate sampling points and eliminate inherent energy changes from lens flare, radial lens fall-off, and changing subject illumination. Misleading information resulting from bottom effects is avoided by the use of Secchi disc readings and proper choice of wavelength for analyzing the photos.

Author

N74-18951 Wisconsin Univ., Madison.
TOWARDS UNDERSTANDING ENVIRONMENTAL IMPACT: MONITORING AND ANALYZING LEVELS OF EXISTING LAND ALTERATION Ph.D. Thesis

Michael Martin McCarthy 1973 217 p
Avail: Univ. Microfilms Order No. 73-21166

Both photographic and non-photographic remote sensing imagery data from 1940 to the present were collected for the study. Selectively timed color infrared aerial photography was found to be an effective means of monitoring levels of land alteration. Of all the photographic and non-photographic imagery, color infrared film taken during the spring was the most explicit in the delineation of areas of exotic and opportunistic plant communities and, conversely, the levels of existing impact. A central concern relates to methods of quantifying levels of environmental alteration. Quantification of these levels is presented by investigating means of mechanically analyzing a given film. Through a processes of sampling various quantified levels of impact are correlated with other environmental variables and the results presented. Dissert. Abstr.

N74-18964*# Geological Survey, Reston, Va. Geographic Applications Program.

URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report, Dec. 1973

Robert H. Alexander, Principal Investigator 20 Dec. 1973 7 p EREP
(NASA Order T-5290-B)
(E74-10355; NASA-CR-137040) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. The arrival of the so-called energy crisis makes the portion of

this experiment dealing with land use climatology of more immediate significance than before, since in addition to helping to understand the processes of climatic change associated with urbanization, the knowledge obtained may be useful in assigning an energy balance impact factor to proposed changes in land use in and around cities. Thermal maps derived from S-192 data are to be used as a measure of the energy being radiated into space from the mosaic of different surfaces in and around the city. While presenting excellent spatial sampling potential for a metropolitan area tests site, the Skylab data permit a very poor temporal sampling opportunity, owing to the large number of factors beyond the investigator's control that determine when data will be taken over a given test site. The strategy is to augment the thermal maps derived from S-192 with a modeling technique which enables the simulation of a number of components of the surface energy balance, calculated at regular time intervals throughout the day or year. Preliminary tests on the performance of the model are still underway, using airborne MSS data from NASA aircraft flights. Results look extremely promising.

N74-18968*# Environmental Research Inst. of Michigan, Ann Arbor.

STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Feb. 1974

Irvin J. Sattinger, Principal Investigator 7 Mar. 1974 2 p EREP

(Contract NAS9-13283)

(E74-10359; NASA-CR-137044; ERIM-103300-20-L) Avail: NTIS HC \$4.00 CSCL 08B

N74-18969*# Maine State Highway Dept., Bangor.
MULTIDISCIPLINARY ANALYSIS FOR HIGHWAY ENGINEERING PURPOSES Progress Report

Ernest G. Stoeckeler and Raymond G. Woodman, Principal Investigators 15 Mar. 1974 2 p EREP
(Contract NAS9-13359)

(E74-10360; NASA-CR-137045; PR-1) Avail: NTIS HC \$4.00 CSCL 08B

N74-18974*# General Electric Co., Philadelphia, Pa.
APPLICATION OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA TO URBAN DEVELOPMENT AND REGIONAL PLANNING: TEST SITE - COUNTY OF LOS ANGELES Progress Report, Jul. - Aug. 1973

Surendra Raje, Principal Investigator, Richard Economy, Jene McKnight (Los Angeles County Regional Planning Comm.), Monir Sefain (Los Angeles County Regional Planning Comm.), Darryl Goehring (Los Angeles County Regional Planning Comm.), and Gerald Willoughby (OVAAC 8 Intern., Inc.) Sep. 1973 9 p ERTS

(Contract NAS5-21797)

(E74-10365; NASA-CR-137059) Avail: NTIS HC \$4.00 CSCL 08B

N74-18981*# Minnesota State Planning Agency, St. Paul.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Jan. - 28 Feb. 1974

Joseph E. Sizer, Principal Investigator 28 Feb. 1974 3 p ERTS

(Contract NAS5-21801)

(E74-10372; NASA-CR-137069) Avail: NTIS HC \$4.00 CSCL 08B

N74-19000*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 28 Feb. 1974

Roland S. Yunghans, Edward B. Feinberg, Frank J. Wobber, Robert L. Mairs, Principal Investigators, Robert T. Macomber, Dennis Stanczuk, and JoAnn Stitt 19 Mar. 1974 5 p Prepared for N. J. Dept. of Environ. Protect. ERTS
 (Contract NAS5-21765)

(E74-10391; NASA-CR-137209) Avail: NTIS HC \$4.00 CSCL 08A

The author has identified the following significant results. Rapid access to ERTS data was provided by NASA GSFC for the February 26, 1974 overpass of the New Jersey test site. Forty-seven hours following the overpass computer-compatible tapes were ready for processing at EarthSat. The finished product was ready just 60 hours following the overpass and delivered to the New Jersey Department of Environmental Protection. This operational demonstration has been successful in convincing NJDEP as to the worth of ERTS as an operational monitoring and enforcement tool of significant value to the State. An erosion/accretion severity index has been developed for the New Jersey shore case study area. Computerized analysis techniques have been used for monitoring offshore waste disposal dumping locations, drift vectors, and dispersion rates in the New York Bight area. A computer shade print of the area was used to identify intensity levels of acid waste. A Litton intensity slice print was made to provide graphic presentation of dispersion characteristics and the dump extent. Continued monitoring will lead to the recommendation and justification of permanent dumping sites which pose no threat to water quality in nearshore environments.

N74-19003*# Environmental Research Inst. of Michigan, Ann Arbor.

OIL POLLUTION DETECTION, MONITORING AND LAW ENFORCEMENT Quarterly Progress Report

Robert Horvath, Principal Investigator 20 Mar. 1974 2 p EREP

(Contract NAS9-13281)

(E74-10394; NASA-CR-137212; ERIM-101800-10-L) Avail: NTIS HC \$4.00 CSCL 08J

N74-19948*# Geological Survey, Reston, Va. Water Resources Div.

DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Jan. - 28 Feb. 1974

Edward J. Pluhowski, Principal Investigator 1 Mar. 1974 3 p ERTS

(NASA Order S-70243-AG-2)

(E74-10413; NASA-CR-137272) Avail: NTIS HC \$4.00 CSCL 08H

The author has identified the following significant results. Imagery obtained on 25 January 1974, shows a well-defined plume at the mouth of the Niagara River and a much smaller but intense plume emanating from Port Dalhousie Harbor, Ontario. Additionally, a plume can be seen trailing eastward from the outer end of the Welland Canal. This is the first time that a clear-cut winter view of these plumes was detected by the ERTS-1 satellite outside the navigation season. Since the Welland Canal was not in operation, it is likely that the plume, visible along the canal's outer jetty on frames 1551-15313-4-5, was the result of westward moving turbid water emanating from Port Dalhousie Harbor to the west.

N74-19950*# Geological Survey, Reston, Va.

THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Jan. - 28 Feb. 1974

Daniel B. Krinsley, Principal Investigator 7 Mar. 1974 3 p ref ERTS

(NASA Order S-70243-AG-3)

(E74-10415; NASA-CR-137274) Avail: NTIS HC \$4.00 CSCL 08H

The author has identified the following significant results. Seasonal monitoring of hydrologic conditions at three playa lakes provides a basis for constructing an annual water inventory for these lakes. Although the extreme variation in the extent of playa lakes must be considered, the principal periods of their fluctuations are generally constant. Playa lakes provide an important water source for arid region needs, and their water can be diverted and stored for use during the long, hot, and dry summer. At their 1973 maxima, approximately 400 million cu m and 794 million cu m of water were available at the lakes at Qom and Neriz playas, respectively. These lakes adjoin areas of moderately dense population that have severe annual water deficits. A preliminary road alignment across the Great Kavir in north-central Iran has been prepared from an analysis of ERTS-1 images of that area from September 2, 1972, through May 12, 1973, a total of 6 scenes. An all-weather road constructed along this alignment could reduce the distance between points north and south of the Great Kavir by as much as 700 km.

N74-19951*# Geological Survey, Reston, Va. Geographic Applications Program.

CENSUS CITIES EXPERIMENT IN URBAN CHANGE DETECTION Progress Report, 1 Jul. - 31 Dec. 1973

James R. Wray, Principal Investigator and Valerie A. Milazzo 1 Mar. 1974 7 p ERTS

(NASA Order S-70243-AG-2)

(E74-10417; NASA-CR-137276) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. Mapping of 1970 and 1972 land use from high-flight photography has been completed for all test sites: San Francisco, Washington, Phoenix, Tucson, Boston, New Haven, Cedar Rapids, and Pontiac. Area analysis of 1970 and 1972 land use has been completed for each of the mandatory urban areas. All 44 sections of the 1970 land use maps of the San Francisco test site have been officially released through USGS Open File at 1:62,500. Five thousand copies of the Washington one-sheet color 1970 land use map, census tract map, and point line identification map are being printed by USGS Publication Division. ERTS-1 imagery for each of the eight test sites is being received and analyzed. Color infrared photo enlargements at 1:100,000 of ERTS-1 MSS images of Phoenix taken on October 16, 1972 and May 2, 1973 are being analyzed to determine to what level land use and land use changes can be identified and to what extent the ERTS-1 imagery can be used in updating the 1970 aircraft photo-derived land use data base. Work is proceeding on the analysis of ERTS-1 imagery by computer manipulation of ERTS-1 MSS data in digital format. ERTS-1 CCT maps at 1:24,000 are being analyzed for two dates over Washington and Phoenix. Anniversary tape sets have been received at Purdue LARS for some additional urban test sites.

N74-19970*# Kanner (Leo) Associates, Redwood City, Calif.
REMOTE DETECTION OF POLLUTION OF WATER RESERVOIRS AND PHYTOPLANKTON BY OPTICAL METHODS

K. Ya. Kondratyev, A. A. Buznikov, and D. V. Pozdnyakov Washington NASA Mar. 1974 20 p refs Transl. into ENGLISH from Vod. Resur. (USSR), no. 3, 1972 p 65-74

(Contract NASw-2481)

(NASA-TT-F-14767) Avail: NTIS HC \$4.00 CSCL 08H

Remote detection of polluted water surfaces and phytoplankton by optical methods is described. Spectral characteristics obtained by spaceborne photography and infrared spectroscopy are compared with the spectral properties of unpolluted water surfaces. Oil slicks were detected by the change of thermodynamic equilibrium of the water surface. Comparisons are made between the spectral characteristics of oil and chlorophylls. The increased production of phytoplankton due to the release of chemically active wastes, such as nitrogen compounds, is also described. S.K.W.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N74-20016*# Wisconsin Univ., Madison. Inst. for Environmental Studies.

PHOTOGRAPHIC QUANTIFICATION OF WATER QUALITY IN MIXING ZONES

Thomas M. Lillesand (State Univ. of New York), Frank L. Scarpace, and James L. Clapp [1973] 26 p refs Sponsored in part by Dept. of Natural Res., State of Wisconsin (Grant NGL-50-002-127)

(NASA-CR-137268) Avail: NTIS HC \$4.50 CSCL 14E

A method was developed to quantitatively delineate waste concentrations throughout waste effluent mixing zones on the basis of densitometric measurements extracted from aerial photography. A mixing zone is the extent of a receiving water body utilized to dilute a waste discharge to a concentration characteristic of a totally mixed condition. Simultaneously-acquired color infrared photography and suspended solids water samples were used to quantitatively delineate the mixing zone resulting from the discharge of a paper mill effluent. Digital scanning microdensitometer data was used to estimate and delineate suspended solids concentrations on the basis of a semi-empirical model. Photographic photometry, when predicated on a limited amount of ground sampling, can measure and delineate mixing zone waste distributions in more detail than conventional surface measuring techniques. The method has direct application to: (1) the establishment of definite and rational water quality guidelines; (2) the development of sampling and surveillance programs for use by governmental and private agencies; and (3) the development of design and location criteria for industrial and municipal waste effluent outfalls.

Author

N74-20954*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.

LAND USE IN NORTHERN MEGALOPOLIS Bimonthly Progress Report, Feb. - Mar. 1974

Robert B. Simpson, Principal Investigator 29 Mar. 1974 2 p refs ERTS

(Contract NAS5-21749)

(E74-10426; NASA-CR-137352; BMPR-9) Avail: NTIS HC \$4.00 CSCL 08B

N74-20978*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A DETAILED PROCEDURE FOR THE USE OF SMALL-SCALE PHOTOGRAPHY IN LAND USE CLASSIFICATION

Paul L. Vegas (Mississippi Test Facility, Bay St. Louis) Washington Apr. 1974 45 p ref

(NASA-TN-D-7542; JSC-S-372) Avail: NTIS HC \$3.25 CSCL 08B

A procedure developed to produce accurate land use maps from available high-altitude, small-scale photography in a cost-effective manner is presented. An alternative procedure, for use when the capability for updating the resultant land use map is not required, is also presented. The technical approach is discussed in detail, and personnel and equipment needs are analyzed. Accuracy percentages are listed, and costs are cited. The experiment land use classification categories are explained.

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A74-19914 Use of the Navy Satellite System in geodetic surveying. M. B. Ignagni (Honeywell, Inc., Minneapolis, Minn.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-10, Jan. 1974, p. 128-135. 6 refs.

The question of how multiple-pass data from the Navy Satellite System can be processed to yield an optimal estimate of the latitude, longitude, and elevation of a point on the earth's surface is considered. It is demonstrated that the problem can be treated by use of modern estimation techniques. Two methods are considered: Kalman estimation and weighted least-squares estimation. The variance of the estimation errors is compared for a simulated sequence of 50 satellite passes. (Author)

A74-20608 # Route marking for large-scale aerial surveying (O markirovke marshrutov krupnomasshtabnoi aeros'emki). G. N. Timushev (L'vovskii Politekhnikeskii Institut, Lvov, Ukrainian SSR). *Geodeziia, Kartografiia i Aerofotos'emka*, no. 17, 1973, p. 112-116. In Russian.

The difficulties involved in meeting high accuracy requirements placed on the laying out of aerial survey routes are examined, and the mathematical treatment of deviations from a prescribed route is discussed. Procedures for calculating the required number of routes and for selecting landmarks with adequate characteristics are outlined. V.P.

A74-20626 Combined evaluation of satellite and aerial photographs for topographic mapping (Kombinierte Auswertung von Satelliten- und Luftbildern für die topographische Kartierung). O. Kölbl. Karlsruhe, Universität, Fakultät für Bauingenieur- und Vermessungswesen, Dr.-Ing. Dissertation, 1973. 123 p. 89 refs. In German.

The techniques used for obtaining photographs of terrestrial surface areas for mapping applications are considered, giving attention to the altitude of the satellite employed, the cameras used, the film material, and the photographic pictures required for the mapping. The assignment of image elements is discussed together with the geometric quality of photographs obtained with the aid of satellites. Error-producing effects in the procedure for the transformation of satellite photographs by means of an optical projection method are investigated and a suitable approach is presented for the areawise assignment of image elements from photographs obtained with the aid of aircraft and satellites. G.R.

A74-21460 An operational camera calibration by the stellar method at NOAA/NOS. L. W. Fritz and H. H. Schmid (NOAA, Rockville, Md.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 285-307.

The need for a high-precision photogrammetric camera to acquire the required overlapping terrain was recognized in connection with the concept concerning the establishment of a lunar geodetic reference system. A maximum focal length of 80 mm became mandatory in order to provide the wide angle characteristics necessary for assuring the geometric strength of the photogrammetric triangulation. A new lens had to be developed to satisfy the operational requirements. The extensive geometrical and optical performance calibration of the lens is reported. G.R.

A74-23246 # Selection of optimal spectral intervals for a study of natural formations from outer space (Optimal'nyi vybor spektral'nykh intervalov pri izuchenii prirodnykh obrazovaniy iz kosmosa). K. Ia. Kondrat'ev, O. B. Vasil'ev, and G. A. Ivanian. *Kosmicheskie Issledovaniia*, vol. 12, Jan.-Feb. 1974, p. 122-128. 12 refs. In Russian.

Informativeness evaluation of different spectral regions in earth surface feature surveys indicates that the set of spectral channels of the ERTS satellite is not optimal. The spectral contrasts of ERTS are found to differ considerably from those inferred from Soyuz 7 and 9 data. Analysis of spectral entropy and contrasts at wavelengths from 0.4 to 0.9 microns suggests that the most informative wavelengths are 0.54 to 0.56, 0.66 to 0.69, and 0.78 to 0.82 microns. V.Z.

A74-23441 Stereostroboscopic methods for surveying dynamic processes. M. I. Burov (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) and V. I. Nefedov. (*Geodeziia i Aerofotos'emka*, no. 2, 1972, p. 85-92.) *Geodesy and Aerophotography*, no. 1-3, 1972, p. 99-102. Translation.

A74-24172 Satellite geodesy with cameras and lasers. D. G. King-Hele (Royal Aircraft Establishment, Space Dept., Farnborough, Hants., England). *Endeavour*, vol. 33, Jan. 1974, p. 3-10. 32 refs.

Newton's calculation of the earth's flattening at the poles is taken up as the foundation of modern geodesic inquiry. In dynamic satellite geodesy, measurements are made of the perturbations of a satellite's orbit caused by irregularities in the earth's gravitational field. The shape of the earth's sea level surface, or the geoid, as given by a slice through the poles, can be treated as if it were composed of an infinite series of harmonics, each harmonic representing a tendency of the earth's shape away from the perfect spherical shape. Calculations based on orbital observations obtain values for the harmonic coefficients. Through the use of lasers, the distance from observation point to satellite can be determined to within 50 cm at a range of 1000 km. The 1969 Smithsonian Standard Earth is shown as an example of a map of the earth giving geoid height by contour lines at 10-meter intervals. P.T.H.

A74-24448 The 'Radam Project' - Radargrammetry of the Amazon basin (Das 'Radam-Projekt' - Radargrammetrie im Amazonasbecken). P. M. Fagundes (Geofoto, S.A., Rio de Janeiro, Brazil). *Bildmessung und Luftbildwesen*, vol. 42, Mar. 1, 1974, p. 47-52. In German. (Translation).

Planimetric maps (scale: 1:250,000) and thematic maps (geological and geomorphological maps, maps of vegetation and soil use, forest maps) of the Amazon basin were made by means of an integrated system of 7 to 8 sensors. The sensing system consisted of a sidelooking radar with synthetic aperture, an extrawide-angle camera for IR photographs, an I2S multispectral camera, and a television system. Tie points were determined by the Shoran system for which the secondary stations were obtained from the orbital data of active geodesic satellites. P.T.H.

A74-25396 Space photography for renovation of topical maps of the World's Physico-Geographical Atlas. B. V. Vinogradov (Laboratory of Aerial and Space Methods of Earth Sciences, Leningrad, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 201-211. 11 refs.

A74-25436 Figures of merit for the optical landscape classification. Y. S. Tolchelnikov and T. M. Hazanova (Ministry of Geology of the USSR, Laboratory on Aeromethods, Leningrad, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 871-881. 12 refs.

To identify the landscape components and their properties (geological structure, composition of rocks, features of the vegetable and soil covers, etc.) by optical signs the detailed 'optical' classification connecting the optical properties of geosystems with their physical-geographical nature is required. The complex of characteristics describing fully the optical properties of the most widespread geosystems is laid as the basis of this classification. An attempt is made to work out the system of figures of merit which must be established as a basis for the optical classification of natural objects. F.R.L.

A74-25439 * An interpretation of a geologic map of Fannin County, Texas, prepared by ADP techniques from ERTS MSS data. J. A. Henderson, Jr., J. E. Cipra (Purdue University, Lafayette, Ind.), and J. V. Gardner (Indiana State University, Terre Haute, Ind.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 915-924. Contract No. NAS5-21785; Grant No. NGL-15-005-112.

A74-26620 # Data evaluation by covariance analysis, exercised on photographic satellite observations. G. Seeber (Bonn, Universität, Bonn, West Germany). *International Association of Geodesy and Australian Academy of Science, Symposium on Earth's Gravitational Field and Secular Variations in Position, University of New South Wales, Sydney, Australia, Nov. 26-30, 1973, Paper.* 11 p. 8 refs.

As an example of a multiparametric stochastic process of vector-type, some plates obtained with a high accuracy sidereal driven satellite camera are studied. The subject of analysis is the set of residuals obtained after reduction with different models. If, besides the white noise, there is any statistical information left, it produces correlations between the residuals, which can be described using different characteristic functions. Quantitative tests show that, with simple models, it is possible to extract all of the information from the plates, so that a directional accuracy of a few tenth of arc seconds can be expected. In connection with precise laser distances, such direction measurements can contribute to geodynamical studies. (Author)

A74-26727 Geologic implications of a satellite view of Ellesmere Island, Canada. D. J. Brooks and G. A. Rabchevsky (Terratek, Inc., Lanham, Md.). *Modern Geology*, vol. 4, no. 2, 1973, p. 131-135. 8 refs.

A74-26729 * Imaging radars provide terrain texture and roughness parameters in semi-arid environments. H. C. MacDonald and W. P. Waite (Arkansas, University, Fayetteville, Ark.). *Modern Geology*, vol. 4, no. 2, 1973, p. 145-158. 9 refs. Contract No. NAS9-10261.

Geoscience potentialities and limitations of available imaging radars are examined for alluvial valley-playa terrain environments. In such arid environments, a dual-sensor combination of an imaging radar with aerial photography is shown to provide a practical method for monitoring gross changes in surface textures of alluvial fans and

playa surface conditions. It also appears feasible to infer surface materials and relative surface roughness with an improved degree of interpretive reliability. M.V.E.

A74-27927 # Device for recording the position of the light-beam axis (Ustroistvo dlia registratsii polozheniia osi svetovogo puchka). R. A. Movsesian, A. A. Martirosian, Iu. M. Abramian, E. V. Tuzov, E. A. Khased, and Iu. P. Artemov. *Geodeziia i Kartografiia*, Jan. 1974, p. 23-28. 13 refs. In Russian.

The electrooptical device described will establish the position of the laser-beam axis as the datum line in space for geodetic precision measurements. The device will measure remotely two coordinates of the beam axis in a plane normal to the beam. V.P.

A74-28117 # Geodesy programs (Programmes de géodésie). J. C. Husson (Centre National d'Etudes Spatiales, Brétigny-sur-Orge, Essonne, France) and M. Lefebvre (Groupe de Recherche de Géodésie Spatiale, Brétigny-sur-Orge, Essonne, France). In: Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings. Paris, Centre National d'Etudes Spatiales, 1973, p. 125-130. In French.

The history of space geodesy is sketched, with special emphasis on developments in France. Current projects include a new D5B satellite which will be equipped with 26 reflectors for tracking by laser and will be used to measure nongravitational forces. The DIALOGUE satellite is scheduled to be launched in 1977 and will be tracked by radio methods. Its localization system will be calibrated by laser telemetry. The principal problem in the use of optical tracking and distance finding methods would appear to be the difficulty of obtaining operational meteorological conditions over extended periods of time. P.T.H.

A74-28321 American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974. 638 p. Members, \$2.50; nonmembers, \$5.00.

Recent advances in photogrammetry are described in papers dealing with photographic materials, spacecraft and airborne imaging systems, digital image processing techniques, methods used for registration of remotely gained imagery, aerotriangulation procedures, and results of applications of remote multispectral imagery to specific earth resource monitoring tasks. Some particular topics include sensor performance evaluation of the Skylab multispectral photographic facility, stereo orthophoto error analysis, detection of anomalies in crops and forest vegetation, computer-aided enhancement of image resolution and contrast, and problems encountered in defining the positional accuracy of satellite imagery. T.M.

A74-28332 Low-cost analytical aerotriangulation for rectification of aerial photographs. R. A. Dickson (U.S. Department of Agriculture, Western Aerial Photography Laboratory, Salt Lake City, Utah). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 252-261.

The feasibility of an employment of computational aerotriangulation was investigated in connection with the desire of the Agricultural Stabilization and Conservation Service to use photography at the scale of 1:40,000 in order to reduce the cost of the procurement of aerial photography. The investigation was concerned with the development of a system that would achieve the accuracy standards required and process the large volume of photography needed. G.R.

A74-28341 Automated land-use mapping from spacecraft data. R. H. Rogers and L. E. Reed (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 417-431. 8 refs.

ERTS spectral data were used along with computer land-use classification-recognition techniques to obtain land-use maps of a 625 square mile test site. The land-use classifications chosen were: urban and built-up land, tended grass, extractive land, rangeland, forest land, deep water, shallow water, and nonforested wetlands. The mapping performance (accuracy, repeatability, etc.) satisfied Anderson's (1971) working criteria at publication scales of 1:250,000 and smaller. As the map scale approaches 1:24,000, mapping errors become more apparent. Computer-generated overlays were obtained within a two to three-day time period. These processing speeds, coupled with the fact that ERTS tapes are relatively inexpensive (\$160 per ERTS scene) and are available on a routine basis (every 17 days), are believed to provide a significant breakthrough in the art of developing and updating land-use maps.

P.T.H.

A74-28347 Geometric evaluation of MSS images from ERTS-1. J. W. Schoomaker, Jr. (U.S. Geological Survey, Reston, Va.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1974, p. 582-588. 5 refs.

N74-16006* Naval Research Lab., Washington, D.C. **TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY** Monthly Progress Report, Dec. 1973

Allan Shapiro, Principal Investigator 28 Jan. 1974 6 p EREP (NASA Order T-4716-B)

(E74-10219; NASA-CR-136482) Avail: NTIS HC \$3.00 CSCL 08B

N74-16063* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

MICHIGAN EXPERIMENTAL MULTISPECTRAL MAPPING SYSTEM: A DESCRIPTION OF THE M7 AIRBORNE SENSOR AND ITS PERFORMANCE Technical Report, Dec. 1970 - Jun. 1972

Philip G. Hasell, Jr. Jan. 1974 156 p refs (Contract NAS9-9384)

(NASA-CR-134177; ERIM-190900-10-T) Avail: NTIS HC \$10.00 CSCL 08B

The development and characteristics of a multispectral band scanner for an airborne mapping system are discussed. The sensor operates in the ultraviolet, visual, and infrared frequencies. Any twelve of the bands may be selected for simultaneous, optically registered recording on a 14-track analog tape recorder. Multispectral imagery recorded on magnetic tape in the aircraft can be laboratory reproduced on film strips for visual analysis or optionally machine processed in analog and/or digital computers before display. The airborne system performance is analyzed.

Author

N74-17084* Battelle Columbus Labs., Ohio.

CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Jan. 1974

A. G. Mourad and D. M. J. Fubara, Principal Investigators 18 Feb. 1974 7 p EREP

(Contract NAS9-13276)

(E74-10295; NASA-CR-136682; PR-11) Avail: NTIS HC \$3.00 CSCL 08E

N74-17995* Geological Survey, Reston, Va. **CARTOGRAPHIC EVALUATION OF SKYLAB-A S-192 SCANNER IMAGES** Quarterly Progress Report, 1 Nov. 1973 - 31 Jan. 1974

John D. McLaurin, Principal Investigator 31 Jan. 1974 6 p EREP

(NASA Order T-4111-B)

(E74-10305; NASA-CR-136787) Avail: NTIS HC \$4.00 CSCL 08B

N74-18068* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

THE REMOTE IDENTIFICATION OF TERRAIN FEATURES AND MATERIALS AT KANSAS TEST SITES: AN INVESTIGATIVE STUDY OF TECHNIQUES Interim Report, 1970-1972

Thomas W. Wagner and Philip G. Hasell, Jr. Jun. 1973 55 p refs

(Contract DOT-FH-11-7136)

(PB-224962/1GA; ERIM-196200-1-T) Avail: NTIS HC \$4.75 CSCL 08M

The report documents the collection, processing, and analysis of multispectral data gathered in airborne flights over three test sites in northeastern Kansas during the early spring of 1970. The overall objective for this investigation, as well as for others covered by the same contract, is to develop techniques for automatically identifying, in remotely sensed multispectral imagery, selected terrain features and natural materials. Specific objectives of the studies reported were to: (1) classify automatically soils of different textures or parent materials based on their spectral reflectance characteristics, (2) detect a subsurface cavity in a suburban area of Kansas City, and (3) attempt to evaluate the condition of concrete pavement and bridge decks along a section of Interstate 35. The first objective was achieved during the period covered by this report; the other two were not. (Modified author abstract) (GRA)

N74-18958* Inter-American Geodetic Survey, Fort Clayton (Canal Zone).

CARTOGRAPHIC EXPERIMENT FOR LATIN AMERICA Progress Report, 1 Aug. 1973 - 28 Feb. 1974

Jack E. Staples, Principal Investigator 28 Feb. 1974 30 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(NASA Order T-4651-B)

(E74-10349; NASA-CR-136957) Avail: NTIS \$4.50 CSCL 08B

The author has identified the following significant results. The two experiments clearly demonstrate the practical application of the Skylab photography to update existing maps at an optimum scale of 1:100,000. The photography can even be used, by employing first order photogrammetric instruments, for updating the cultural features in 1:50,000 scale mapping. The S190A imagery has also shown itself to be most economical in preparing new photomap products over previously unmapped areas, such as Concepcion, Paraguay. These maps indicate that Skylab quality imagery is invaluable to the Latin American cartographers in their efforts to provide the mapping products required to develop their countries. In Latin America, where over 5,000 people are employed in map production and where the Latin American governments are expending over \$20 million in this effort, the use of such systems to maintain existing mapping and publish new mapping over previously unmapped areas, is of great economic value and could release the conventional Latin American mapping resources to be utilized to produce large scale 1:25,000 and 1:1,000 scale mapping that is needed for specific development projects.

N74-18965* Naval Research Lab., Washington, D.C.

TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Jan. 1974

Allan Shapiro, Principal Investigator 5 Mar. 1974 2 p EREP (NASA Order T-4716-B)

(E74-10356; NASA-CR-137041) Avail: NTIS HC \$4.00 CSCL 08E

03 GEODESY AND CARTOGRAPHY

N74-18970*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-28 Feb. 1974

A. G. Mourad and D. M. J. Fubara, Principal Investigators 15 Mar. 1974 34 p refs EREP
(Contract NAS9-13276)
(E74-10361; NASA-CR-137046; PR-12) Avail: NTIS HC \$4.75 CSCL 08E

The author has identified the following significant results. The analysis was based on a time series intrinsic relationship between the satellite ephemeris, altimeter measured ranges, and the corresponding a priori values of subsatellite geoidal heights. Using, least squares processing with parameter weighting, the objective was to recover: (1) the absolute geoidal heights of the subsatellite points; and (2) the associated altimeter calibration constants. Preliminary results from Skylab mission SL-2 are given, using various combinations from two sets of orbit ephemeris and altimeter ranges. It is shown that correctly scaled geoidal heights cannot be deduced by merely subtracting the altimeter range from the geodetic height of the satellite unless the satellite ephemeris and the altimeter have no unknown significant systematic errors or biases and drifts. It is emphasized that the primary objective of the Skylab altimeter is to determine the instrument feasibility. Any additional applications of the data such as for geodesy, geophysics, and oceanography are desirable. Although accurate orbit is required for such applications, it is not a prerequisite for determining the instrument feasibility.

N74-18982*# Environmental Research Inst. of Michigan, Ann Arbor.

THIRTEEN CATEGORY RECOGNITION MAP OF YELLOWSTONE NATIONAL PARK PRODUCED FROM ERTS-1 MSS DATA

F. Thomson, Principal Investigator, N. Roller, Harry Smedes (USGS), Ralph Root (Natl. Park Serv.), and Don DeSpain (Natl. Park Serv.) 25 Mar. 1974 4 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21783)
(E74-10373; NASA-CR-137070; ERIM-193300-43-L) Avail: NTIS HC \$4.00 CSCL 08B

N74-18986*# Service de la Carte de la Vegetation CNRS, Toulouse (France).

MANAGEMENT OF NATURAL RESOURCES THROUGH AUTOMATIC CARTOGRAPHIC INVENTORY Progress Report, Feb. - Dec. 1973

P.-A. Rey, Yves Gourinard, Francis Cambou, Principal Investigators, J. C. Guyader, P. Gouaux, T. LeToan, M. Monchant, B. Donville, and D. Loubet Dec. 1973 87 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E74-10377; NASA-CR-137162; PR-2) Avail: NTIS HC \$7.50 CSCL 08B

The author has identified the following significant results. Significant results of the ARNICA program (February - December 1973) were: (1) The quantitative processing of ERTS-1 data was developed along two lines: the study of geological structures and lineaments of Spanish Catalonia, and the phytogeographical study of the forest region of the Landes of Gascony (France). In both cases it is shown that the ERTS-1 imagery can be used in establishing zonings of equal quantitative interpretation value. (2) In keeping with the operational transfer program proposed in previous reports between exploration of the imagery and charting of the object, a precise data processing method was developed, concerning more particularly the selection of digital equidensity samples computer display and rigorous referencing.

(1) Accurate recognition of previously known ground features from ERTS-1 imagery has been confirmed and a probable detection range for the major signatures can be given. (2) Unidentified elements, however, must be decoded by means of the equal densitometric value zone method. (3) Determination of these zonings involves an analogical treatment of images using the color equidensity methods (pseudo-color), color composites and especially temporal color composite (repetitive superposition). (4) After this analogical preparation, the digital equidensities can be processed by computer in the four MSS bands, according to a series of transfer operations from imagery and automatic cartography.

N74-18987*# Service de la Carte de la Vegetation CNRS, Toulouse (France).

MANAGEMENT OF NATURAL RESOURCES THROUGH AUTOMATIC CARTOGRAPHIC INVENTORY Progress Report, Apr. - Dec. 1973

P.-A. Rey, Yves Gourinard, and Francis Cambou, Principal Investigators Jan. 1974 37 p refs Sponsored by NASA ERTS

(E74-10378; NASA-CR-137163; PR-3) Avail: NTIS HC \$5.00 CSCL 08B

The author has identified the following significant results. (1) Accurate recognition of previously known ground features from ERTS-1 imagery has been confirmed and a probable detection range for the major signatures can be given. (2) Unidentified elements, however, must be decoded by means of the equal densitometric value zone method. (3) Determination of these zonings involves an analogical treatment of images using the color equidensity methods (pseudo-color), color composites and especially temporal color composite (repetitive superposition). (4) After this analogical preparation, the digital equidensities can be processed by computer in the four MSS bands, according to a series of transfer operations from imagery and automatic cartography.

N74-18990*# Geological Survey, Reston, Va.
INVESTIGATION OF ERTS/RBV AND MSS IMAGERY FOR PHOTOMAPPING OF THE UNITED STATES Progress Report, 1 Jul. - 31 Dec. 1973

Joseph T. Pilonero, Principal Investigator 1 Jan. 1974 3 p ERTS

(NASA Order S-70243-AG)
(E74-10381; NASA-CR-137166) Avail: NTIS HC \$4.00 CSCL 08B

N74-18991*# Geological Survey, Reston, Va. Geographic Applications Program.

LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Jul. - 31 Dec. 1973

John L. Place, Principal Investigator 1 Jan. 1974 5 p ERTS (NASA Order S-70243-AG)

(E74-10382; NASA-CR-137167) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. Changes in the land use in the Phoenix (1:250,000 scale) Quadrangle in Arizona have been mapped using only the images from ERTS-1, tending to verify the utility of a land use classification system proposed for use with ERTS images. Seasonal changes were studied on successive ERTS-1 images, particularly large scale color composite transparencies for August, October, February, and May, and this seasonal variation aided delineation of land use boundaries. Types of equipment used to aid interpretation included color additive viewer, a twenty-power magnifier, a density slicer, and a diazo copy machine. A Zoom Transfer Scope was used for scale and photogrammetric adjustments. Types of changes detected have been: (1) cropland or rangeland developed as new residential areas; (2) rangeland converted to new cropland or to new reservoirs; and (3) possibly new activity by the mining industries. A map of land use previously compiled from air photos was updated in this manner. ERTS-1 images complemented air photos: the photos gave detail on a one-shot basis; the ERTS-1 images provided currency and revealed

seasonal variation in vegetation which aided interpretation of land use.

N74-18992*# Geological Survey, Reston, Va.
THE CARTOGRAPHIC APPLICATION OF ERTS/RBV IMAGERY IN POLAR REGIONS Progress Report, 1 Jul. - 31 Dec. 1973

William R. MacDonald, Principal Investigator: 1 Jan. 1974 4 p
 ERTS
 (NASA Order S-70243-AG-2)
 (E74-10383; NASA-CR-137168) Avail: NTIS HC \$4.00 CSCL
 08B

N74-19016# Ohio State Univ., Columbus. Dept. of Geodetic Science.

THE OHIO STANDARD BASELINE, 1970.9 Ph.D. Thesis
 S. F. Cushman 1972 187 p refs
 (Rept-207) Avail: NTIS HC \$12.50 CSCL 08E

The establishment of the Ohio Standard Baseline is discussed in terms of site conditions and instrumentation. The calibration of the etalon is detailed. Other topics discussed include: coordinate systems; computing the length of the standard baseline; effects of weather and site soil composition on the accuracy of measurements; air temperature; and compensation. The observations of interference for 1970 are included. K.M.M.

N74-19030# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

RADARGEOLICAL OBSERVATIONS ON THE LOW HILLY TERRAIN AMIDST PIAUI, PERNAMBUCO AND BAHIA STATE, BRAZIL

Liu Chang Chiang Apr. 1973 19 p
 (INPE-336-RI/112) Avail: NTIS HC \$4.00

The use of SLAR mosaic as a geological tool in mapping the low hilly terrain of Brazil is examined. Only terrain with monotonous Precambrian rocks with similar erosional resistance, lack of characteristic appearance, and poor outcrops due to thick soil cover was considered. Fifteen radargeologic rock units, various faults and fractures, as well as anticlinal and synclinal foldings were identified. Author

N74-19035*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DIGITAL IMAGE REGISTRATION METHOD BASED UPON BINARY BOUNDARY MAPS

R. R. Jayroe, J. F. Andrus, and C. W. Campbell Washington
 Mar. 1974 36 p refs
 (NASA-TN-D-7607; M-121) Avail: NTIS HC \$3.25 CSCL
 08B

A relatively fast method is presented for matching or registering the digital data of imagery from the same ground scene acquired at different times, or from different multispectral images, sensors, or both. It is assumed that the digital images can be registered by using translations and rotations only, that the images are of the same scale, and that little or no distortion exists between images. It is further assumed that by working with several local areas of the image, the rotational effects in the local areas can be neglected. Thus, by treating the misalignments of local areas as translations, it is possible to determine rotational and translational misalignments for a larger portion of the image containing the local areas. This procedure of determining the misalignment and then registering the data according to the misalignment can be repeated until the desired degree of registration is achieved. The method to be presented is based upon the use of binary boundary maps produced from the raw digital imagery rather than the raw digital data. Author

N74-19933 Ohio State Univ., Columbus.
AERODIST CONTROLLED PHOTOGRAPHY FOR TOPOGRAPHIC MAPPING Ph.D. Thesis

Rae Alden Stewart 1973 306 p
 Avail: Univ. Microfilms Order No. 74-3325

The Aerodist controlled photography system, which provides the supplementary survey control densification required for topographic mapping was tested. It was proven that the Aerodist controlled photography system is more than adequate for the provision of auxiliary planimetric control for Class A topographic mapping at the scale of 1/50,000 (NATO specifications). It was also shown that such auxiliary control satisfies the requirements for Class B mapping at the scale of 1/25,000. Furthermore, the results strongly indicate that, with the realization of suggested improvements in the calibration of the exposure - ranging delay time, plus an optimum choice of aerial camera and flying height, the system is capable of providing the required planimetric accuracy for Class A mapping at the scale of 1/25,000.

Dissert. Abstr.

N74-20958*# Naval Research Lab., Washington, D.C.
TERRAIN PROPERTIES AND TOPOGRAPHY FROM SKYLAB ALTIMETRY Monthly Progress Report, Mar. 1974

Allan Shapiro, Principal Investigator 22 Apr. 1974 1 p EREP
 (NASA Order T-4716-B)
 (E74-10431; NASA-CR-137378) Avail: NTIS HC \$4.00 CSCL
 08E

04 GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A74-20196 # The geomagnetic field and its analytical representation (Geomagnitnoe pole i ego analiticheskoe predstavlenie). A. J. Zmuda (Johns Hopkins University, Silver Spring, Md.). *Geomagnetizm i Aeronomiia*, vol. 13, Nov.-Dec. 1973, p. 1098-1109. 75 refs. In Russian.

The fundamentals are reviewed which form the basis of the International Geomagnetic Reference Field (IGRF) established in 1968 to facilitate the coordination of geophysical investigations based on the use of analytical representations of the geomagnetic field in spherical harmonics. Results of recent calculations are examined, and the range in which the IGRF should correspond to ground-based and satellite data is discussed. V.P.

A74-20606 # A method of determining the declination position elements and the dip angle of geological beds from aerial photos (Sposob opredeleniia po aerosnimkam elementov raspolozheniia sklonov i zaleganiia plastov zemli). A. L. Ivlev (Nauchno-Issledovatel'skii Institut Prikladnoi Geodezii, Novosibirsk, USSR). *Geodeziia, Kartografiia i Aerofototsemka*, no. 17, 1973, p. 99-104. In Russian.

A74-21480 Shoreline geology - Definition by remote sensing. R. E. Hunt (Joseph S. Ward and Associates, Caldwell, N.J.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2.

Falls Church, Va., American Society of Photogrammetry, 1973, p. 819-839.

A study was conducted to determine and evaluate geologic conditions within a project area, review the past and present dredging and disposal methods and assist in the selection, from an engineering point of view, of sites to be used for disposal over the next 50 years. The first project considered involves the construction of an ocean outfall to be constructed in shallow offshore waters with coral reef formations where test boring is extremely difficult and costly. The second project is concerned with a study of dredge spoil disposal along 34 miles of river channel that enters the ocean. G.R.

A74-25110 Geomorphic-geologic mapping from remote sensors. A. J. Lewis (Louisiana State University, Baton Rouge, La.). In: Remote sensing: Techniques for environmental analysis.

Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 105-126.

Geomorphic and geologic studies are shown to have benefited from the use of remote sensing systems (primarily imaging sensors). Sensor and platform data capabilities, regional and local data acquisition, and the qualitative and quantitative nature of the data to be obtained, as well as budgetary constraints, represent the considerations crucial to a judicious selection of sensor or sensors to be used for a given geologic problem or for any other specific (vegetation, land use, etc.) photo-interpretation mission. Each sensor has its own advantages, whether it is resolution, cloud penetration, scale, or EM frequency sensitivity. These advantages may often overlap, but they can also be complementary. M.V.E.

A74-25390 Space television images research - A means of composition of regional tectonic maps and prognoses of earth resources. I. I. Bashilova, V. K. Eremin, and G. V. Makhin (Ministry of Geology of the USSR, Moscow, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 75-97.

A tectonic map of west Siberia, different from known tectonic maps of this region, was made from space television images. The Urals and the lower-Yenisei folding system are bordered by deep faults and thrusts. Probably these structures were formed as a result of stretching. The west Siberian plate is broken by large faults into a number of blocks. The Ob Valley is a wide tectonic belt analogous to the structural joint of the Indus. All the tectonic provinces are of a compound heterogeneous structure, and each of them is divided into a series of mountains and basins often complicated by faults. In the southern part of this region a wide zone of latitudinal faults has been identified. Analyses of space television images are useful in solving many geological problems associated with the search for mineral deposits. (Author)

A74-25392 Preliminary assessment of a Tennessee lineament. E. F. Hollyday, C. R. Burchett (U.S. Geological Survey, Nashville, Tenn.), and G. K. Moore (U.S. Geological Survey, Bay St. Louis, Miss.). In: Remote sensing of earth resources, Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 119-128. 8 refs.

A74-25441 Remote sensing when studying active volcanoes - On example of the Karimski volcano of Kamchatka peninsula. N. A. Gussev and B. V. Shilin (Ministry of Geology of the USSR, Laboratory on Aeromethods, Leningrad, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 935-957. 8 refs. Translation.

Investigations are described which showed the high effectiveness of remote sensing in the study of active volcanoes. A radar survey makes it possible to get important information concerning the regional structural-tectonic position of the Karimski volcano which could not be gotten with the required exactness by other methods including airborne survey because of technical and weather difficulties. The infrared airborne survey makes it possible to obtain repeatedly the real picture of geothermal volcanic activities. The remote sensing of gases and vapors makes it possible to study the character of the volcanic gas explosion, to evaluate the power of an outburst, and to obtain information about possible increase of volcanic activity. F.R.L.

A74-25443 Possible implication of lineaments in the Atlantic Coastal Plain as seen by satellite imagery. C. F. Withington (U.S. Geological Survey, Washington, D.C.) and F. H. Jacobeen, Jr. (South Carolina, University, Columbia, S.C.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 981-996. 7 refs.

A74-25444 Direction of lineaments from the Nimbus-III infrared data derived in the 0.7 to 1.3 micron spectral region. A. A. Grigor'ev (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information

04 GEOLOGY AND MINERAL RESOURCES

Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 997-1003. 12 refs.

A74-25450 Mapping of spoil banks using ERT-A pictures. M. U. Ahmad, D. A. Kantner (Ohio University, Athens, Ohio), and J. W. Antalovich (Kucera and Associates, Inc., Mentor, Ohio). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1073-1093.

A74-25451 Applications of ERTS-1 and aircraft imagery to mined land investigations. O. R. Russell, F. J. Wobber, R. Amato (Earth Satellite Corp., Washington, D.C.), and C. E. Weir (Indiana Geological Survey, Bloomington, Ill.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1095-1106. 7 refs.

ERTS-1 imagery and complementary high-altitude color infrared photography has been applied to geological fracture detection in glacial drift covered areas and to monitoring of surface coal mining activities. Mined land information which is of value to state officials and which can be derived from the analysis of the ERTS imagery includes the areal extent of mining, estimates of vegetal cover, distribution and size of mining-produced water bodies, and differentiation between deciduous and coniferous reforestation. F.R.L.

A74-26617 * # Very long baseline interferometry /VLBI/ applications to secular geodynamics and earth strain measurement. P. F. MacDoran (California Institute of Technology, Jet Propulsion Laboratory, Tracking and Orbit Determination Section, Pasadena, Calif.). *International Association of Geodesy and Australian Academy of Science, Symposium on Earth's Gravitational Field and Secular Variations in Position, University of New South Wales, Sydney, Australia, Nov. 26-30, 1973, Paper. 26 p. 16 refs.* Contract No. NAS7-100.

An instrumental technique from radio astronomy known as very long baseline interferometry (VLBI) offers significant promise for the solution of the problem of accurate long-distance, three-dimensional surveying and determination of whole earth geodynamical phenomena. The methods of VLBI make it possible for receiving stations to be independently operated at arbitrary separations using extragalactic radio sources as their frame of time-invariant angular reference. Feasibility demonstrations at S-band (13 cm) wavelengths have been performed, and accuracies of a few centimeters for three-dimensional surveying over a short distance (16 km) have been demonstrated. VLBI operation on longer baselines (8400 km) has been performed between Goldstone, California, and Madrid, Spain, in order to develop the capability for determination of universal time variations, in addition to the measurements of this intercontinental baseline. Systems analysis indicates that necessary calibrations can be developed so as to make possible the implementation of a transportable radio interferometer station concept.

(Author)

A74-26618 * # 3-D multilateration for measurement of earth crustal deformation and network densification. K. M. Ong (California Institute of Technology, Jet Propulsion Laboratory, Tracking and Orbit Determination Section, Pasadena, Calif.). *International Association of Geodesy and Australian Academy of Science, Symposium on Earth's Gravitational Field and Secular Variations in Position, University of New South Wales, Sydney, Australia, Nov. 26-30, 1973, Paper. 25 p. 6 refs.* Contract No. NAS7-100.

Discussion of how range and range-difference data types can make possible precise three-dimensional measurement of ground

station positions and the position of an artificial signal source, without explicit dependence upon the signal source trajectory. An effective strategy for such measurement is to combine the multilateration approach with a VLBI system using natural radio sources. The VLBI methods would provide a coarse grid of three-dimensional benchmark locations on a regional and global scale. Multilateration stations would then occupy these coarse grid locations and provide a means for highly portable, relatively low-cost units to then densify networks on a regional and local scale. Because a multilateration approach can make use of strong artificial radio sources, it makes possible the use of relatively low-cost, highly mobile stations. Such mobile stations are virtually essential for three dimensional surveying in heavily urbanized areas or in rugged terrain. (Author)

A74-26619 * # The earth's gravitational field from the combination of satellite and terrestrial data. R. H. Rapp (Ohio State University, Columbus, Ohio). *International Association of Geodesy and Australian Academy of Science, Symposium on Earth's Gravitational Field and Secular Variations in Position, University of New South Wales, Sydney, Australia, Nov. 26-30, 1973, Paper. 33 p. 66 refs.* Contract No. F19628-72-C-0120; Grant No. NGR-36-008-161.

This paper reviews techniques and results in the combination of gravimetric and satellite data. The estimation of mean anomalies for use in combination studies is discussed with the location of current gravity material being described. Specific techniques for combination solutions are discussed for various models. These models include those where the gravitational field is represented by a set of potential coefficients, or by a set of discrete blocks distributed on the earth. The potential coefficient solutions compared are those of the SAO Standard Earth II and III, the Goddard Earth Model 4, and a solution by the author. These solutions are compared in terms of coefficients, undulation and anomaly differences, and implied anomaly degree variances. In addition, comparisons were made through terrestrial anomaly comparisons, astrogeodetic undulation comparisons, and orbit fitting tests. (Author)

A74-27216 # Geological and geomorphological interpretation of global cosmic earth photographs from the automatic interplanetary probe Zond 5 (Geologo-geomorfologicheskoe deshifirovanie global'nykh kosmicheskikh fotosnimkov zemli, poluchennykh AMS 'Zond-5'). D. S. Asolian (Akademii Nauk SSSR, Institut Geografii, Moscow, USSR) and V. D. Skariatina (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 5, 1973, p. 65-74. 8 refs. In Russian.

A74-27217 # Synoptic geology or satellites for planetary geology (Sinopticheskaiia geologiia ili sputniki dlia planetarnoi geologii). M. Nazirov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 5, 1973, p. 75-85. 7 refs. In Russian.

Consideration of the significance of meteorological satellite observations as a source of global geological information. A satellite photograph of a developing eddy cloud structure in an atmospheric cyclone region is compared with a satellite photograph of a snow-capped portion of the Himalayas to indicate a striking external resemblance of both features. Other available associated data are analyzed to suggest that there is an implicit similarity in large-scale and global structures of the atmosphere and the lithosphere. Particular attention is given to the analogy between the planar and spatial structures of an atmospheric eddy system and those of the folded ridges in the Himalayas. V.Z.

A74-28029 * Geological and environmental applications of the ERTS data. C. C. Schnetzler (NASA, Goddard Space Flight Center, Planetology Branch, Greenbelt, Md.). *Journal of Environmental Sciences*, vol. 17, Mar.-Apr. 1974, p. 29-35.

The significant results from geological investigations made with the aid of the ERTS spacecraft can be grouped into four broad categories: mapping, land form analysis, structural studies, and the search for mineral deposits. Illustrations of how ERTS has been used in such studies are given, including photomosaics of Nevada and of southern Morocco, and a photogeological interpretation of the Rhodesian craton. Environmental applications of ERTS are illustrated by an ERTS update of an Indiana strip mine map, an ERTS image of Lake Michigan showing particulate plumes and their effect on the weather, and an image of the New York Bight area showing the location and extent of an acid-iron wastes dump and a sewage sludge dump. P.T.H.

A74-28333 Remote sensing and photogeology - Mineral exploration. S. A. Estrin, G. V. Wolstenholme, and J. M. Pilner (Lockheed Electronics Co., Inc., Houston, Tex.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 274-280. 10 refs.

Remote sensing techniques in mineral exploration involve the measurement of surface phenomena by an approach in which the measuring device is not physically in contact with the earth's surface. Photogeology is the interpretation of the recorded surface phenomena for the determination of zones which are worthy of intensive on-the-ground exploration. On the basis of an investigation it is concluded that remote sensing and photogeology are adaptable to the search for fluorite. G.R.

N74-16005* Servicio Geologico de Bolivia, La Paz. **TECTONICS SUBPROGRAM: STRUCTURAL GEOLOGY OF THE NORTHERN PLATEAU OF BOLIVIA (SOUTH OF PERU AND NORTH OF CHILE) [SUB-PROGRAMA TECTONOFISICA: GEOLOGIA ESTRUCTURAL DEL ALTIPLANO NORTE DE BOLIVIA (SUR DEL PERU Y NORTE DE CHILE)]** C. E. Brockmann, Principal Investigator and Claude Martinez 13 Dec. 1973 13 p In SPANISH Sponsored by NASA ERTS (E74-10212; NASA-CR-136394) Avail: NTIS HC \$3.00 CSCL 08G

N74-16007* Indiana Geological Survey, Bloomington. Coal Section. **APPLICATION OF ERTS-1 IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY** Progress Report, 1 Jul. 1973 - 1 Jan. 1974 Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas V. Leshendok Jan. 1974 27 p ref Prepared in cooperation with Earth Satellite Corp., Washington, D. C. ERTS (Contract NAS5-21795) (E74-10238; NASA-CR-136536) Avail: NTIS HC \$3.50 CSCL 08I

The author has identified the following significant results. New fracture detail of Indiana has been observed and mapped from ERTS-1 imagery. Studies so far indicate a close relationship between the directions of fracture traces mapped from the imagery, fractures measured on bedrock outcrops, and fractures measured in the underground mines. First hand observations and discussions with underground mine operators indicate good correlation of mine hazard maps prepared from ERTS-1/aircraft imagery and actual roof falls. The inventory of refuse piles/slurry ponds of the coal field of Indiana has identified over 225 such sites from past mining operations. These data will serve the State Legislature in making tax decisions on coal mining which take on increased importance because of the energy crisis.

N74-16012* Stanford Univ., Calif. School of Earth Sciences. **STRUCTURAL AND LITHOLOGIC STUDY OF NORTHERN CALIFORNIA COAST RANGE AND SACRAMENTO VALLEY, CALIFORNIA** Progress Report, 1 Jul. - 20 Dec. 1973 Ernest I. Rich, Principal Investigator and William Clinton Steele

Dec. 1973 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-21775) (E74-10251; NASA-CR-136565) Avail: NTIS HC \$3.50 CSCL 08E

The author has identified the following significant results. Photogeologic examination of repetitive multispectral ERTS-1 imagery of Northern California has disclosed several systems of linear features which may be important for the interpretation of the structural history of California. They are separated from an orthogonal system of linears in the Klamath Mts. by a set of discontinuous southeast-trending linear features (the Mendocino system) which is traceable from the Pacific Coast, at Cape Mendocino, into the eastern foothills of the Sierra Nevada. Within the Sierra Nevada, the Mendocino system separates the north-trending Sierran system from a set of linears characteristic of the Modoc Plateau. With minor exception, little overlap exists among the systems which suggests a decipherable chronology and evolutionary history for the region. The San Andres system of linears appears to truncate or co-exist with most of the other systems in the northern Coast Ranges. The Mendocino system truncates the Klamath, Sierran, and Modoc systems. The Sierran system may represent fundamental and long-persisting pre-late Paleozoic zones of crustal weakness which have been reactivated from time to time. The Mendocino system was possibly developed in early Mesozoic and is important to the structural framework of Northern California.

N74-16016* Colorado School of Mines, Golden. Dept. of Geology. **GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO** Progress Report, 1 Dec. 1973 - 31 Jan. 1974 Daniel H. Knepper, Jr., Principal Investigator 30 Jan. 1974 3 p ERTS (Contract NAS5-21778) (E74-10255; NASA-CR-136583) Avail: NTIS HC \$3.00 CSCL 08F

N74-16018* Texas Technological Univ., Lubbock. Remote Sensing Lab. **DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS** Progress Report, 1 Dec. 1973 - 31 Jan. 1974 C. C. Reeves, Jr., Principal Investigator 31 Jan. 1974 2 p ERTS (Contract NAS5-21720) (E74-10257; NASA-CR-136585) Avail: NTIS HC \$3.00 CSCL 08H

N74-16019* Indiana Geological Survey, Bloomington. **APPLICATION OF EREP IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS AND ENVIRONMENTAL PROBLEMS IN MINING** Quarterly Progress Report, 20 Oct. 1973 - 20 Jan. 1974 Charles E. Wier, Frank J. Wobber, Roger V. Amato, and Orville R. Russell, Principal Investigators 22 Jan. 1974 14 p ref Prepared in cooperation with Earth Satellite Corp., Washington, D. C. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS9-13358) (E74-10258; NASA-CR-136586; QPR-3) Avail: NTIS HC \$3.00 CSCL 08I

The author has identified the following significant results. All Skylab 2 imagery received to date has been analyzed manually and data related to fracture analysis and mined land inventories has been summarized on map-overlays. A comparison of the relative utility of the Skylab image products for fracture detection, soil tone/vegetation contrast mapping, and mined land mapping has been completed. Numerous fracture traces were detected on both color and black and white transparencies. Unique fracture

trace data which will contribute to the investigator's mining hazards analysis were noted on the EREP imagery; these data could not be detected on ERTS-1 imagery or high altitude aircraft color infrared photography. Stream segments controlled by fractures or joint systems could be identified in more detail than with ERTS-1 imagery of comparable scale. ERTS-1 mine hazards products will be modified to demonstrate the value of this additional data. Skylab images were used successfully to update a mined land map of Indiana made in 1972. Changes in mined area as small as two acres can be identified. As the Energy Crisis increases the demand for coal, such demonstrations of the application of Skylab data to coal resources will take on new importance.

N74-16025*# New York State Museum and Science Service, Albany.
ANALYSIS OF ERTS-1 LINEAR FEATURES IN NEW YORK STATE Progress Report, Jun. 1973 - Jan. 1974
 Yngvar W. Isachsen, Principal Investigator, Robert H. Fakundiny, and Stephen W. Forster 14 Feb. 1974 73 p refs Original contains imagery. Original photography may be purchased from the FROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57196 ERTS
 (Contract NAS5-21764)
 (E74-10264; NASA-CR-136650) Avail: NTIS HC \$5.75 CSCL 08G

The author has identified the following significant results. All ERTS-1 linears confirmed to date have topographic expression although they may appear as featureless tonal linears on the imagery. A bias is unavoidably introduced against any linears which may parallel raster lines, lithological trends, or the azimuth of solar illumination. Ground study of ERTS-1 topographic lineaments in the Adirondacks indicates: outcrops along linears are even more rare than expected, fault breccias are found along some NNE lineaments, chloritization and slickensiding without brecciation characterize one EW lineament whereas closely-spaced jointing plus a zone of plastic shear define another. Field work in the Catskills suggests that the prominent new NNE lineaments may be surface manifestations of normal faulting in the basement, and that it may become possible to map major joint sets over extensive plateau regions directly on the imagery. Fall and winter images each display some unique linears, and long linears on the fall image commonly appear as aligned segments on the winter scene. A computer-processed color composite image permitted the extraction or additional information on the shaded side of mountains.

N74-16027*# Argus Exploration Co., Los Angeles, Calif.
STRUCTURAL LINEAMENTS IN THE SOUTHERN SIERRA NEVADA, CALIFORNIA
 Mark A. Liggett, Principal Investigator and John F. Childs Feb. 1974 11 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
 (Contract NAS5-21809)
 (E74-10279; NASA-CR-136665) Avail: NTIS HC \$3.00 CSCL 08G

The author has identified the following significant results. Several lineaments observed in ERTS-1 MSS imagery over the southern Sierra Nevada of California have been studied in the field in an attempt to explain their geologic origins and significance. The lineaments are expressed topographically as alignments of linear valleys, elongate ridges, breaks in slope or combinations of these. Natural outcrop exposures along them are characteristically poor. Two lineaments were found to align with foliated metamorphic roof pendants and screens within granitic country rocks. Along other lineaments, the most consistent correlations were found to be alignments of diabase dikes of Cretaceous age, and younger cataclastic shear zones and minor faults. The location of several Pliocene and Pleistocene volcanic centers at or near lineament intersections suggests that the lineaments may represent zones of crustal weakness which have provided conduits for rising magma.

N74-16028*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.

FEASIBILITY OF USING S-191 INFRARED SPECTRA FOR GEOLOGICAL STUDIES FROM SPACE Monthly Reports, Dec. 1973 and Jan. 1974

R. J. P. Lyon and F. R. Honey, Principal Investigators 31 Jan. 1974 3 p EREP.

(Contract NAS9-13357)

(E74-10285; NASA-CR-136671) Avail: NTIS HC \$3.00 CSCL 08G

N74-17067*# Iowa Univ., Iowa City. Dept. of Geology.
EXPERIMENT TO EVALUATE FEASIBILITY OF UTILIZING SKYLAB-EREP REMOTE SENSING DATA FOR TECTONIC ANALYSIS OF THE BIGHORN MOUNTAINS REGION, WYOMING-MONTANA Quarterly Progress Report, 1 Oct. - 31 Dec. 1973

Richard A. Hoppin, Principal Investigator 8 Feb. 1974 4 p EREP

(Contract NAS9-13313)

(E74-10273; NASA-CR-136659) Avail: NTIS HC \$3.00 CSCL 08G

The author has identified the following significant results. S-190A color transparencies from SL-2 of the Big Horn basin region provide the best format to date for geologic study of that region; red beds are quite mappable and resistant key beds sharply outlined. An S-190B color frame from SL-3 of the Pryor-Bighorn mountains provides no indication that the Nye-Bowler lineament extends east of East Pryor Mountain. This has important implications regarding the role of this and other lineaments (which also appear to be of restricted length) in the tectonics of the region. Extensions of these lineaments for great distances does not seem warranted on the basis of surface evidence.

N74-17075*# Rockwell International Science Center, Thousand Oaks, Calif.

TECTONIC ANALYSIS OF BAJA CALIFORNIA AND PARRAS SHEAR BELT IN MEXICO Progress Report, Jun. - Nov. 1973

Monem Abdel-Gawad, Principal Investigator and Linda Tubbesing Jan. 1974 30 p refs ERTS

(Contract NAS5-21767)

(E74-10283; NASA-CR-136669; SC543.9PR) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. Geological correlation of terrain across the Gulf of California using ERTS-1 imagery revealed significant similarities between Isla Tiburon, Isla Angel de la Guarda, and the San Carlos Range in mainland Mexico. ERTS-1 imagery was used to check the validity of the existence of major trans-Baja fault zones. ERTS-1 imagery also shows that high albedo sediments similar to known late Tertiary marine sediments are widespread in southern and middle Baja and extend in places to the eastern side of the Peninsula. Major faults in northern Mexico and across the border in the United States were mapped, and ample evidence was found that the Parras and parts of the Texas lineament are belts of major transverse shear faults in areas outside the supposed limit of the Texas and Parras lineaments. A fundamental concept which may help explain many complexities in the tectonic development is beginning to emerge: The southwestern part of North America was torn by massive left-lateral shear of transverse trend (east-west) during the compressive stage of the late Mesozoic and early Cenozoic. This tectonic style has changed into tensional rifting (Basin and Range) and right-lateral shear later in the Cenozoic and Quaternary.

N74-17076*# Rockwell International Science Center, Thousand Oaks, Calif.

IDENTIFICATION AND INTERPRETATION OF TECTONIC

FEATURES FROM ERTS-A IMAGERY Progress Report, 1 Dec. 1973 - 31 Jan. 1974

Monem Abdel-Gawad, Principal Investigator 6 Feb. 1974 3 p ERTS

(Contract NAS5-21767)

(E74-10284; NASA-CR-136670; SC543.10PR) Avail: NTIS HC \$3.00 CSCL 08G

The author has identified the following significant results. A set of criteria characterizing known mineralized areas are: (1) occurrence at structural bends, discontinuities, complex deformations along fault zones and intersections; (2) complex terrain textures produced by fracture intersections; (3) color and tone anomalies produced by igneous intrusives, alteration effects, and oxidation. Significant fracture systems which appear to be most commonly related to mineralization in central and northeastern Nevada trend northeast-southwest, north-south, and north-northwest. In the area from Goldfield and Beatty, Nevada, to south of Las Vegas, ERTS-1 and Skylab imagery have been examined together to study an apparent correlation of mineralized areas with suspected hydrothermal alteration effects. It was observed that areas of mineralization are of complex structure, usually cut by many fractures, and sometimes have a similar mottled or variegated appearance. Although the Beatty-Rhyolite mining district is now largely inactive, several analogous areas not known to be mineralized have been identified. Identification of specific mineral prospects within general targets requires extensive field work and detailed geophysical exploration.

N74-17088*# California Earth Science Corp., Santa Monica. FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Feb. 1974

Paul M. Merifield, Principal Investigator 5 Feb. 1974 3 p EREP

(Contract NAS2-7698)

(E74-10299; NASA-CR-136693; MPR-8) Avail: NTIS HC \$3.00 CSCL 08E

N74-17096*# Colorado School of Mines, Golden. Dept. of Geology.

GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Jan. 1974
Keenan Lee, Principal Investigator 15 Feb. 1974 7 p EREP
(Contract NAS9-13394)

(E74-10308; NASA-CR-136790) Avail: NTIS HC \$4.00 CSCL 08G

N74-17101*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.

GEOLOGIC ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress Report, 29 Nov. 1973 - 29 Jan. 1974

Frank E. Kottowski, Principal Investigator 29 Jan. 1974 5 p ERTS

(Contract NAS5-21861)

(E74-10314; NASA-CR-136799) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. Many circular to elliptical features have been identified on the ERTS-1 images, only some of which can be accounted for by existing data. A small number of circular features are adjacent to existing ore deposits, but such relationships should not be emphasized unless other supporting data exists. Circular features may be tectonically or geomorphically controlled, or a combination of the two. A limited number are man-made. A preliminary listing of features which may have circular expression are listed. Photographic examples of identified and unidentified circular

features will be included in the final report along with a thorough discussion and analysis. Comparisons will be made with existing gravity and magnetic data.

N74-17111# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.

GEOLOGIC STRUCTURE ANALYSIS USING RADAR IMAGERY OF THE COAL MINING AREA OF BUCHANAN COUNTY, VA.

C. H. Elder, P. W. Jeran, and D. A. Keck 1974 33 p refs

(BM-R1-7869) Avail: NTIS HC \$4.75

An analysis of the geologic structure of an area of Buchanan County, Va., was made using imagery from an airborne AN/APQ-97 side-looking radar system to evaluate a mapping technique for delineating structural features that may cause mining problems. Side-looking airborne radar (SLAR) was found to be a useful remote sensing tool for geologic structural analysis. Fault and joint systems identified by lineaments and linear patterns in the imagery were verified by surface and in-mine observations. Little Paw Paw fault was extended 10 miles by SLAR lineament analysis. A 22-mile fault, here named the Bishop-Bradshaw Creek fault, was mapped by lineament analysis and verified by observation of the fault on the Bishop Coal Co. mine map and on offset patterns of commercial gas production along the fault and surface observation of lineament along the fault. Three major super-imposed joint sets and several fault or fractured zones were identified by SLAR lineament analysis, showing more complex structure than earlier mapping indicated. The SLAR imagery accurately delineated structural features that are known to affect gas migration and accumulation and that weaken the rock forming the immediate roof to mine workings, causing mining problems and potentially hazardous environment in the mines.

Author

N74-18003*# Stanford Univ., Calif. Remote Sensing Lab. FEASIBILITY OF USING S-191 INFRARED SPECTRA FOR GEOLOGICAL STUDIES FROM SPACE Monthly Report, 2 Sep. - 2 Nov. 1973

R. J. P. Lyon, A. A. Green, and F. R. Honey, Principal Investigators 2 Nov. 1973 3 p EREP

(Contract NAS9-13357)

(E74-10327; NASA-CR-136822; MR-3; MR-4) Avail: NTIS HC \$4.00 CSCL 08G

N74-18006*# Colorado School of Mines, Golden. Dept. of Geology.

GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO USING ERTS-1 DATA Progress Report, 1 Jun. - 30 Nov. 1973

Daniel H. Knepper, Principal Investigator, R. M. Hutchinson, D. L. Sawatzky, D. W. Trexler, D. L. Bruns, and S. M. Nicolais Dec. 1973 61 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21778)

(E74-10330; NASA-CR-136825; Rept-73-5; PR-9) Avail: NTIS HC \$6.25 CSCL 08F

The author has identified the following significant results. Topography was found to be the most important factor defining folds on ERTS-1 imagery of northwestern Colorado; tonal variations caused by rock reflectance and vegetation type and density are the next most important factors. Photo-linears mapped on ERTS-1 imagery of central Colorado correlate well with ground-measured joint and fracture trends. In addition, photo-linears have been successfully used to determine the location and distribution of metallic mineral deposits in the Colorado Mineral Belt. True color composites are best for general geologic analysis and false color composites prepared with positive/negative masks are useful for enhancing local geologic phenomena. During geologic analysis of any given area, ERTS-1 imagery from several different dates should be studied.

04 GEOLOGY AND MINERAL RESOURCES

N74-18007*# Eason Oil Co., Oklahoma City, Okla.
EVALUATION OF THE SUITABILITY OF SKYLAB DATA FOR THE PURPOSE OF PETROLEUM EXPLORATION Quarterly Report, Oct. - Dec. 1973
Robert J. Collins, Principal Investigator Dec. 1973 4 p EREP
(Contract NAS9-13297)
(E74-10331; NASA-CR-136842) Avail: NTIS HC \$4.00 CSCL 08G

N74-18009*# Wyoming Univ., Laramie, Dept. of Geology.
LOCATION OF GEOLOGIC STRUCTURES FROM INTERPRETATION OF ERTS-1 IMAGERY, CARBON COUNTY, WYOMING Special Report

R. W. Marrs and R. Barton 5 Mar. 1974 11 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21799)
(E74-10333; NASA-CR-136844; ERTS-1-S-74-2) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. Possible geologic structures in the basin sediments of Carbon County and vicinity were located by interpretation of ERTS-1 imagery. These same structures are not evident on existing conventional geologic maps of the area. Subsequent field checks confirmed much of the geologic interpretation, but revealed that two apparent closed structures identified on the ERTS-1 imagery were actually topographic pseudostructures in flat or homoclinal sediments. Stereoscopic coverage (where available) allows the interpreter to avoid such misinterpretations.

N74-18012*# Earth Satellite Corp., Washington, D.C.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Jan. - 1 Mar. 1974

Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, Roger V. Amato, and Thomas V. Leshendok 26 Feb. 1974 5 p Prepared in cooperation with Indiana Geol. Survey ERTS
(Contract NAS5-21795)
(E74-10336; NASA-CR-136847) Avail: NTIS HC \$4.00 CSCL 08I

The author has identified the following significant results. The mine refuse inventory maps were prepared in response to a need by both the State and the coal industry. The lack of information on the scope of the problem handicapped all people concerned in drafting realistic legislation for a severance tax on coal production to raise funds for restoration of refuse sites. The inventory was conducted rapidly and economically, and demonstrated the benefits which can be derived through remote sensing methods.

N74-18013*# Kennecott Exploration, Inc., Salt Lake City, Utah.
Exploration Services Dept.

RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY COPPER DEPOSITS ON ERTS-1 IMAGERY Progress Report, Jan. - Feb. 1974

John C. Wilson, Principal Investigator Feb. 1974 1 p ERTS
(Contract NAS5-21769)
(E74-10337; NASA-CR-136848) Avail: NTIS HC \$4.00 CSCL 08G

N74-18015*# New York State Museum and Science Service, Albany.

TO EVALUATE ERTS-1 DATA FOR USEFULNESS AS A GEOLOGICAL SENSOR IN THE DIVERSE GEOLOGICAL TERRANES OF NEW YORK STATE Progress Report, Jan. - Feb. 1974

Yngvar W. Isachsen, Principal Investigator 28 Feb. 1974 7 p ERTS
(Contract NAS5-21764)

(E74-10339; NASA-CR-136850) Avail: NTIS HC \$4.00 CSCL 08G

N74-18019*# Dartmouth Coll., Hanover, N.H. Dept. of Earth Sciences.

GROUND SURVEY OF ACTIVE CENTRAL AMERICAN VOLCANOES IN NOVEMBER - DECEMBER 1973 Progress Report, Nov. 1973 - Jan. 1974

Richard E. Stoiber, Principal Investigator and William I. Rose, Jr. (Mich. Technol. Univ.) Feb. 1974 18 p EREP
(Contract NAS9-13311)

(E74-10343; NASA-CR-136855) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. Thermal anomalies at two volcanoes, Santiaguito and Izalco, have grown in size in the past six months, based on repeated ground survey. Thermal anomalies at Pacaya volcano have become less intense in the same period. Large (>500 m diameter) thermal anomalies exist at 3 volcanoes presently, and smaller scale anomalies are found at nine other volcanoes.

N74-18074# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.

GEOLOGIC RECONNAISSANCE AND LITHOLOGIC IDENTIFICATION BY REMOTE SENSING Final Report, 5 May 1972 - 30 Apr. 1973

Robert Vincent, Thomas W. Wagner, Ben Drake, and Phillip Jackson Dec. 1973 119 p refs

(Contract DI-BM-HO-220064; ARPA Order 1579)
(AD-771278; ERIM-191700-8-F) Avail: NTIS CSCL 08/7

The role of remote sensing in geologic reconnaissance for purposes of tunnel site selection was studied further and a test case was undertaken to evaluate this geological application. Airborne multispectral scanning (MSS) data were obtained in May, 1972, over a region between Spearfish and Rapid City, South Dakota. With major effort directed toward the analysis of these data, the following geologic features were discriminated: (1) exposed rock areas, (2) five separate rock groups, (3) large-scale structures. This discrimination was accomplished by ratioing multispectral channels. Laboratory-type remote sensing data are shown to permit geologic interpretation. These technological advances are the first steps toward airborne lithologic identification. The method has the potential for still finer discrimination and, hence, application to more rock types. Author (GRA)

N74-18960*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Feb. 1974

Paul M. Menfield, Principal Investigator 5 Mar. 1974 2 p EREP

(Contract NAS2-7698)
(E74-10351; NASA-CR-137036; MPR-9) Avail: NTIS HC \$4.00 CSCL 08E

N74-18972*# New York State Museum and Science Service, Albany.

EVALUATION OF ERTS-1 IMAGERY FOR SPECTRAL GEOLOGICAL MAPPING IN DIVERSE TERRANES OF NEW YORK STATE Progress Report, Jun. 1972 - May 1973

Yngvar W. Isachsen, Principal Investigator, Robert H. Fakundiny, and Stephen W. Forster 29 Jun. 1973 84 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21764)

(E74-10363; NASA-CR-137058) Avail: NTIS HC \$7.25 CSCL 08G

The author has identified the following significant results. Linear anomalies dominate the new geological information derived

from ERTS-1 imagery, total lengths now exceeding 6000 km. Experimentation with a variety of viewing techniques suggest that conventional photogeologic analyses of band 7 results in the location of more than 97 percent of all linears found. Bedrock lithologic types are distinguishable only where they are topographically expressed or govern land use signatures. The maxima on rose diagrams for ERTS-1 anomalies correspond well with those for mapped faults and topographic lineaments. A multiscale analysis of linears showed that single topographic linears at 1:2,500,000 became dashed linears at 1:1,000,000 aligned zones of shorter parallel, en echelon, or conjugate linears at 1:500,000. Most circular features found were explained away by U-2 airphoto analysis but several remain as anomalies. Visible glacial features include individual drumlins, best seen in winter imagery, drumlinoids, eskers, ice-marginal drainage channels, glacial lake shorelines and sand plains, and end moraines.

N74-18989*# Geological Survey, Reston, Va.
IRON-ABSORPTION BAND ANALYSIS FOR THE DISCRIMINATION OF IRON-RICH ZONES Progress Report, 1 Jul. - 31 Dec. 1973
 Lawrence C. Rowan, Principal Investigator 30 Jan. 1974 11 p refs ERTS
 (NASA Order S-70243-AG-4)
 (E74-10380; NASA-CR-137165) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. Most major rock units and unaltered and altered areas in the study area can be discriminated on the basis of visible and near-infrared spectral reflectivity differences recorded from satellite altitude. These subtle spectral differences are detectable by digital ratioing of the MSS bands and subsequent stretching to increase the contrast to enhance spectral differences. Hydrothermally altered areas appear as anomalous color patches within the volcanic-rock areas. A map has been prepared which can be regarded as an excellent reconnaissance exploration map, for use in targeting areas for more detailed geological, geochemical, and geophysical studies. Mafic and felsic rock types are easily discriminated on the color stretched-ratio composite. The ratioing process minimizes albedo effects, leaving only the recorded characteristic spectral response. The spectra of unaltered rocks appear different from those of altered rocks, which are typically dominated by limonite and clay minerals. It seems clear that differences in spectral shape can provide a basis for discrimination of geologic material, although the relations between visible and near-infrared spectral reflectivity and mineralogical composition are not yet entirely understood.

N74-18994*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 Sep. - 31 Oct. 1973
 Richard S. Williams, Jr., Principal Investigator 1 Nov. 1973 8 p refs Sponsored by NASA ERTS
 (E74-10385; NASA-CR-137170) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. Rhyolitic rocks in the Torfajokull geothermal area and geothermally altered ground in the Torfajokull and Reykjanes geothermal areas can also be delineated. The fallout pattern of tephra from the 1970 eruption from the volcano Hekla can be mapped where sufficient depth of deposition destroyed the vegetation. Standard NDFF 70mm negatives (3rd generation) were used to print enlargements of the volcanic islands of Surtsey and Heimaey. Sufficient resolution is maintained to directly update maps to the 1:100,000 scale. Low-sun angle imagery (< 10 deg) of Iceland has been particularly valuable in mapping new structural and volcanic features hidden beneath glacial ice in Iceland's neovolcanic zone. ERTS-1 imagery has shown the marked differences in volcanic landforms in Iceland from a regional viewpoint. The regional distribution of crater rows, moberg ridges, table (moberg) mountains, calderas, central volcanoes, and shield volcanoes shows striking differences in volcanic geomorphology in different parts of Iceland's neovolcanic zone.

N74-18999*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report, 1 Feb. - 31 Mar. 1974
 Daniel H. Knepper, Jr., Principal Investigator 29 Mar. 1974 3 p ERTS
 (Contract NAS5-21778)
 (E74-10390; NASA-CR-137208) Avail: NTIS HC \$4.00 CSCL 08G

N74-19001*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Feb. 1974
 Keenan Lee, Principal Investigator 22 Mar. 1974 8 p EREP
 (Contract NAS9-13394)
 (E74-10392; NASA-CR-137210) Avail: NTIS HC \$4.00 CSCL 08G

N74-19006*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 Nov. - 31 Dec. 1973
 Edwin D. McKee, Principal Investigator and Carol S. Breed 1 Jan. 1973 12 p refs ERTS
 (NASA Order S-70243-AG-4)
 (E74-10398; NASA-CR-137123) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. Recent acquisition of generally high quality color prints for most of the test sites has enabled the project to make significant advances in preparing mosaics of sand desert areas under study. Computer enhancement of imagery of selected sites, where details of complex dune forms need to be determined, has been achieved with arrival of computer-compatible ERTS-1 tapes. Further, a comparator, recently received, gives precise visual measurements of width, length, and spacing of sand bodies and so improves comparison of patterns in various test sites. Considerable additional meteorological data recently received on sand-moving winds in China, Pakistan, Libya and other areas enabled much progress to be made in developing overlays for the dune mosaics. These data show direction, speed, and frequency of winds. Other new data for use in preparing overlays used with ERTS-1 image mosaics include ground truth on moisture control, geologic settings, and plant distribution. With the addition of visual observation data and prints from hand-held photography now being obtained by the Skylab mission, much progress in interpreting the patterns of sand seas for 17 desert sites is anticipated.

N74-19032# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGY OF THE AREA 'SENHOR DO BONFIM' BASED ON SLAR MOSAIC INTERPRETATION
 Liu Chan Chiang Jan. 1973 19 p
 (Proj. SERE)
 (INPE-278-R1/067) Avail: NTIS HC \$4.00

From the criteria of tonal contrast, drainage pattern, all the landforms and the characteristic distribution and contact relationships of the rocks in the SLAR mosaic, the different rock units were distinguished. These include the basement complex, the plutonic unit, the metamorphic unit, the intrusive plutonic unit, the clastic sedimentary unit, the calcareous sedimentary unit 1 and 2, and the aluvion. From the topographic expressions and their microfeatures, distribution of the aerogeologic rock units, and the lineaments, many folds, faults and features are recognized from the SLAR mosaic. Tombador mountain range divides this area of study into two parts. The sedimentary terrain, which is in the west of Tombador mountain, yields the greatest

amount of information from the radar imagery. The basement complex terrain, which is in the east of the mountain, yields the least information. In the Tombador mountain range there are several large intrusive granite bodies containing prominent dikes, and around the intrusive bodies there are features which suggest contact metamorphosed. Therefore this region of Tombador mountain is hopeful for valuable economic mineral researches. Author

N74-19938*# Iowa Univ., Iowa City.
UTILIZING ERTS-1 IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF THE BIGHORN MOUNTAINS REGION Progress Report, 16 Sep. 1973 - 15 Mar. 1974
Richard A. Hoppin, Principal Investigator 15 Mar. 1974 1 p ERTS
(Contract NAS5-21852)
(E74-10395; NASA-CR-137213) Avail: NTIS HC \$4.00 CSCL 08F

N74-19941*# Geological Survey, Washington, D.C.
EVALUATION OF ERTS-1 DATA APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Progress Report, 1 May - 30 Jun. 1973
William D. Carter, Principal Investigator 28 Sep. 1973 3 p
Sponsored by NASA ERTS
(E74-10405; NASA-CR-137247) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. Segerstrom delineated many grabens (down-faulted blocks) not shown on published maps of Argentina nor of South America. The faults that border the grabens are better appreciated in ERTS-1 imagery than on air photos or on the ground because of the masking affect of alluvial fill deposits. In frame no. 1188-13545 a change in local prevailing wind direction from east to southeast is noted in sand streams. In frame no. 1188-13551 it was surprising to see that Solar del Hombre Muerto was covered with water. In November 1971 the investigator has driven across the salt pan several times without wetting his wheels. It was also possible to differentiate the following rock and soil classes: Granites, metamorphic, volcanic rocks, Tertiary and Quaternary clastic deposits and salt pans. Portions of railroads and highways as well as small towns were identified. In frame no. 1188-13551 the Incahuasi Gold Mine and the Tincalayu Borax Mine were located.

N74-19944*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-1 IMAGERY Progress Report, 1 Feb. - 31 Mar. 1974
Monem Abdel-Gawad, Principal Investigator 4 Apr. 1974 3 p ERTS
(Contract NAS5-21767)
(E74-10409; NASA-CR-137254; SC543.11PR) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. ERTS-1 imagery shows that the southern segment of the San Gabriel fault which controls the west fork of the San Gabriel River is strikingly similar to the Mill Creek Fault in the San Bernardino Mountains. It has also been noted that there is a similarity between the Sierra Madre thrust zone of the San Gabriel Mountains to the Banning thrust of the San Bernardino Mountains. This suggests that the southern San Gabriel fault was once continuous with the Mill Creek fault. When the San Bernardino Mountain block is theoretically moved to the northwest along the San Jacinto fault so that the Mill Creek fault is aligned with the southern part of the San Gabriel fault, it was found that the four transverse fault segments become aligned with the Pinto Fault on the east and with the Raymond-Santa Monica Malibu Fault zone on the west. The reconstruction identifies a continuous zone of transverse faulting extending from the Colorado River Desert to the Pacific. It seems likely that the entire fault zone was once a continuous left-lateral shear. This Anacapa

Shear has probably been subjected to a 50 km left lateral movement. This analysis strongly indicates that the tectonic history of the Transverse Range has been characterized by left lateral shear on transverse faults and right lateral shear on the San Andreas fault system.

N74-19946*# Argus Exploration Co., Los Angeles, Calif.
CRUSTAL EXTENSION AND TRANSFORM FAULTING IN THE SOUTHERN BASIN RANGE PROVINCE
Mark A. Liggett, Principal Investigator and John F. Childs Mar. 1974 54 p refs ERTS
(Contract NAS5-21809)
(E74-10411; NASA-CR-137256) Avail: NTIS HC \$5.75 CSCL 08G

The author has identified the following significant results. Field reconnaissance and study of geologic literature guided by analysis of ERTS-1 MSS imagery have led to a hypothesis of tectonic control of Miocene volcanism, plutonism, and related mineralization in part of the Basin Range Province of southern Nevada and northwestern Arizona. The easterly trending right-lateral Las Vegas Shear Zone separates two volcanic provinces believed to represent areas of major east-west crustal extension. One volcanic province is aligned along the Colorado River south of the eastern termination of the Las Vegas Shear Zone; the second province is located north of the western termination of the shear zone in southern Nye County, Nevada. Geochronologic, geophysical, and structural evidence suggests that the Las Vegas Shear Zone may have formed in response to crustal extension in the two volcanic provinces in a manner similar to the formation of a ridge-ridge transform fault, as recognized in ocean floor tectonics.

N74-19947*# Geological Survey, Reston, Va.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 Nov. - 31 Dec. 1973
Richard S. Williams, Jr., Principal Investigator 1 Jan. 1974 10 p refs Sponsored by NASA ERTS
(E74-10412; NASA-CR-137271) Avail: NTIS HC \$4.00 CSCL 08G

The author has identified the following significant results. The seasonal change in size of sediment plumes from the many glacial rivers which discharge into the sea along the south coast gives an indication of seasonal changes in melting rates of glaciers. Changes in area of lakes, particularly glacier-margin lakes can be mapped of most of the area covered by glacial ice in Iceland. Recently deglaciated terrain can be distinguished on MSS color composites. The increase in surface area of the ice-dammed lake, Graenalón, was monitored until the occurrence of a jokulhlaup, after which the surface area of the lake was considerably reduced. The effect of two subglacial jokulhlaups on the overlying ice cover can be seen in the form of collapse features in the surface of Vatnajökull. MSS color composites permit the mapping of five distinct vegetation types; forests, cultivated areas, grasslands, reclaimed areas, and lichen-covered bedrock. Features as small as 100 m can be discerned. The ability to map landforms, vegetation distribution, occurrence of snowcover, glaciers, and geologic structure stereoscopically permits a much greater accurate analysis of these features.

N74-19952*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES Progress Report, 1 Jul. 1973 - 1 Jan. 1974
Jules D. Friedman, Principal Investigator 1 Jan. 1974 6 p ref ERTS
(NASA Order S-70243-AG)
(E74-10418; NASA-CR-137277) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. By the end of 1973, aerial infrared scanner traverses for thermal anomaly recordings of all Cascade Range volcanoes were essentially completed. Amplitude level slices of the Mount Baker anomalies were completed and compiled at a scale of 1:24,000, thus producing, for the first time, an accurate map of the distribution and intensity of thermal activity on Mount Baker. The major thermal activity is concentrated within the crater south

of the main summit and although it is characterized by intensive solfataric activity and warm ground, it is largely subglacial, causing the development of sizable glacier perforation features. The outgoing radiative flux from the east breach anomalies is sufficient to account for the volume of ice melted to form the glacier perforations. DCP station 6251 has been monitoring a thermally anomalous area on the north slope of Mount Baker. The present thermal activity of Mount Baker accounts for continuing hydrothermal alteration in the crater south of the main summit and recurrent debris avalanches from Sherman Peak on its south rim. The infrared anomalies mapped as part of the experiment SR 251 are considered the basic evidence of the subglacial heating which was the probable triggering mechanism of an avalanche down Boulder Glacier on August 20-21, 1973.

N74-19953*# Environmental Research Inst. of Michigan, Ann Arbor.

MAPPING EXPOSED SILICATE ROCK TYPES AND EXPOSED FERRIC AND FERROUS COMPOUNDS FROM A SPACE PLATFORM Quarterly Report, 8 Sep. - 8 Dec. 1973

Robert K. Vincent, Principal Investigator 5 Apr. 1974 2 p EREP

(Contract NAS9-13317)

(E74-10419; NASA-CR-137278; ERIM-102000-18-L) Avail: NTIS HC \$4.00 CSCL 08G

N74-19955*# Nevada Univ., Reno. Mackay School of Mines. **THE GREAT BASIN INVESTIGATION** Monthly Progress Report, Mar. 1974

Jack G. Quade, Principal Investigator Mar. 1974 3 p EREP (Contract NAS9-13274)

(E74-10421; NASA-CR-137280) Avail: NTIS HC \$4.00 CSCL 08E

N74-19958*# Colorado School of Mines, Golden. Dept. of Geology.

APPLICATION OF REMOTE SENSOR DATA TO GEOLOGIC ANALYSIS OF THE BONANZA TEST SITE COLORADO Semiannual Progress Report, 1 Apr. - 30 Sep. 1973

Keenan Lee, Comp., R. W. Butler, J. C. Fisher, D. Huntley, R. L. Hulstrom, D. H. Knepper, J. R. Muhm, D. L. Sawatzky, K. E. Worman, and D. Wychgram Oct. 1973 48 p refs (Grant NGL-06-001-015)

(NASA-CR-137363; Rept-73-4) Avail: NTIS HC \$5.50 CSCL 08G

Research activities on geologic remote sensing applications for Colorado are summarized. Projects include: regional and detailed geologic mapping, surficial and engineering geology, fracture studies, uranium exploration, hydrology, and data reduction and enhancement. The acquisition of remote sensor data is also discussed. K.M.M.

N74-20948*# Texas Instruments, Inc., Dallas.

ERTS-1 IMAGERY USE IN RECONNAISSANCE PROSPECTING: EVALUATION OF COMMERCIAL UTILITY OF ERTS-1 IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Final Report, 20 Aug. 1972 - 23 Oct. 1973

D. F. Saunders, G. E. Thomas, Principal Investigators, F. E. Kinsman, and D. F. Beatty Dec. 1973 162 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21796)

(E74-10345; NASA-CR-136857; U1-702700-F) Avail: NTIS HC \$11.25 CSCL 08G

The author has identified the following significant results. This study was performed to investigate applications of ERTS-1

imagery in commercial reconnaissance for mineral and hydrocarbon resources. ERTS-1 imagery collected over five areas in North America (Montana; Colorado; New Mexico-West Texas; Superior Province, Canada; and North Slope, Alaska) has been analyzed for data content including linears, lineaments, and curvilinear anomalies. Locations of these features were mapped and compared with known locations of mineral and hydrocarbon accumulations. Results were analyzed in the context of a simple-shear, block-coupling model. Data analyses have resulted in detection of new lineaments, some of which may be continental in extent, detection of many curvilinear patterns not generally seen on aerial photos, strong evidence of continental regmatic fracture patterns, and realization that geological features can be explained in terms of a simple-shear, block-coupling model. The conclusions are that ERTS-1 imagery is of great value in photogeologic/geomorphic interpretations of regional features, and the simple-shear, block-coupling model provides a means of relating data from ERTS imagery to structures that have controlled emplacement of ore deposits and hydrocarbon accumulations, thus providing a basis for a new approach for reconnaissance for mineral, uranium, gas, and oil deposits and structures.

N74-20950*# Geological Survey, Menlo Park, Calif.

IDENTIFICATION OF GEOSTRUCTURES OF CONTINENTAL CRUST PARTICULARLY AS THEY RELATE TO MINERAL RESOURCE EVALUATION Progress Report, 1 Jul. - 31 Dec. 1973

George Gryc, Principal Investigator and Ernest H. Lathram 28 Feb. 1974 41 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70243-AG-1)

(E74-10416; NASA-CR-137275) Avail: NTIS HC \$5.25 CSCL 08G

The author has identified the following significant results. New mineral deposits have recently been discovered in eastern Alaska through application of a hypothesis very similar to one developed in interpretation of Nimbus and ERTS-1 imagery in this investigation, that mineral deposits may be spatially related to a set of crustal linears. The discovery affirms the validity of this hypothesis and provides an additional exploration rationale to the mineral industry. A regional lineation in lakes near Umiat in northern Alaska, suspected to reflect structures in basement and suggesting areas of possible potential for new petroleum exploration, is found to cover a much larger area than previously suspected east of the Colville River, increasing the area of interest. Further application of this same imagery exists in that environmental scars to the tundra resulting from previous ground exploration, if of large size, can be recognized and their natural revegetation monitored by use of ERTS imagery. New geologic data obtained from ERTS-1 images of lowland areas of western northern Alaska facilitates assessing the petroleum potential of this area. Use of the images in field mapping permitted extrapolation of field observations. Mosaics of ERTS-1 images have provided additional data on regional linear sets and on other regional fault trends possibly related to mineralized areas.

N74-20956*# California Earth Science Corp., Santa Monica. **FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA** Monthly Progress Report, Mar. 1974

Paul M. Merifield, Principal Investigator 5 Apr. 1974 2 p EREP

(Contract NAS2-7698)

(E74-10429; NASA-CR-137365; MPR-10) Avail: NTIS HC \$4.00 CSCL 08E

N74-20970# Joint Publications Research Service, Arlington, Va.

TECTONIC, GEOLOGICAL STUDIES OF EARTH USING SPACE PHOTOGRAPHS

27 Mar. 1974 28 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 67-74. 140-149 (JPRS-61581) Avail: NTIS HC \$4.50

An article on interpreting the tectonic structure of young epiplatform mountain formations on earth photographs from space is presented along with an article on special methods for the remote study of the earth for geological purposes.

N74-20971 Joint Publications Research Service, Arlington, Va. INTERPRETABILITY OF TECTONIC STRUCTURES OF REGIONS OF YOUNG EPIPLATFORM MOUNTAIN FORMATION ON SPACE PHOTOGRAPHS OF THE EARTH (IN THE EXAMPLE OF THE SOUTHWESTERN TIEN SHAN)

V. I. Makarov *In its* Tectonic, Geol. Studies of Earth using Space Photo. (JPRS-61581) 27 Mar. 1974 p 1-11 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 67-74

The feasibility of using images of the earth obtained from space for studying the tectonics of young epiplatform mountains is analyzed for the Tien Shan. The morphology, structures, and development of the recent tectonic depressions are discussed. The correlation of deformations noted on space photographs with known dislocations is considered evidence of the possibility for structural-geomorphological analysis. F.O.S.

N74-20972 Joint Publications Research Service, Arlington, Va. SPECIAL METHODS FOR THE REMOTE STUDY OF THE EARTH FOR GEOLOGICAL PURPOSES

A. G. Ryabukhin *In its* Tectonic, Geol. Studies of Earth using Space Photo. (JPRS-61581) 27 Mar. 1974 p 12-25 refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka (Moscow), no. 7, 1973 p 140-149

Methods are discussed for the remote registration of the invisible electromagnetic spectrum of the earth's radiation for studying geological structures. The methods discussed include spectrometry, infrared, and radar. F.O.S.

05 OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A74-19312 Measurement of subsurface seawater properties using airborne lasers. L. A. Young (Avco Everett Research Laboratory, Inc., Everett, Mass.). In: NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973, p. 34-37. 12 refs.

Discussion of the use of airborne laser receivers for the collection of subsurface oceanographic data. The technique is aimed at obtaining information more rapidly, in greater detail, and at lesser expense than is possible by surface-based (i.e., boat) methods. The parameters governing measurements of seawater temperature, transparency, and depth are examined, along with those relevant to the determination of chlorophyll and sulfate concentration. M.V.E.

A74-20696 # Life cycle of a Gulf Stream anticyclonic eddy observed from several oceanographic platforms. G. A. Gotthardt and G. J. Potocsky (U.S. Naval Oceanographic Office, Washington, D.C.). *Journal of Physical Oceanography*, vol. 4, Jan. 1974, p. 131-134. 6 refs.

Combined use of satellite infrared imagery, and shipboard and aircraft bathythermograms provided near-synoptic observations of the movement and subsequent recapture of a Gulf Stream anticyclonic eddy by a large meander northeast of Cape Hatteras. The eddy drifted westward for over four months along the continental slope at speeds of 4 to 5 cm/sec before rejoining the Gulf Stream, coalescing with a large meander northeast of Cape Hatteras. The meander was subsequently observed for an additional month after recapture translating eastward at 15 cm/sec. Meander movement resembles that of a similar feature observed in 1970, which resulted in formation of a cyclonic Gulf Stream eddy. (Author)

A74-21402 The detection of nearshore eddy motion and wind-driven currents using NOAA 1 sea surface temperature data. F. M. Vukovich (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Geophysical Research*, vol. 79, Feb. 20, 1974, p. 853-860. 25 refs. Contract No. NOAA-2-35184.

A74-21457 American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1 - Technical sessions. Part 2 - Symposium on remote sensing in oceanography. Falls Church, Va., American Society of Photogrammetry, 1973. Pt. 1, 603 p.; pt. 2, 472 p. Price of part one, members, \$2.50; nonmembers, \$5.00; part two, members, \$5.00; nonmembers, \$10.00.

The subjects considered are in the areas of aerial surveying, instruments and materials, special methods and applications, computational photogrammetry, remote sensing, close-range photogrammetry, and Latin-American applications. Other topics discussed are related to ocean properties, offshore processes, coastal morphology and engineering, estuarine processes, wetlands, and the nearshore environment.

G.R.

A74-21469 * Satellite ocean color measurements. W. R. McCluney (NASA, Goddard Space Flight Center, Earth Observations Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 595-606. 10 refs.

The application of pattern recognition to ocean color data analysis is considered. Due to weight, cost, and data transmission rate limitations, any mapping type remote sensor of ocean color must necessarily collect light from the sea in a finite number of channels. The optical properties of the sea are discussed together with the remote sensing of ocean color, an optical model of natural water, the microscopic optical model, the macroscopic optical model, multiple scattering theory, measurements of subsurface oceanographic parameters, measurements of bulk absorption and scattering properties, measurements of the up- and down-welling light field, and the techniques for ocean color data analysis. G.R.

A74-21471 Remote spectrophotometric measurements of portions of the world's oceans and lakes. R. C. Ramsey (TRW Systems Group, Redondo Beach, Calif.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 613-640.

A multichannel ocean color sensor (MOCS) was built and flight-tested over various waters. All data-gathering flights with the instrument were conducted at an altitude near 11 km and a ground speed near 26 m/sec, which approximates the velocity over height of a low-orbiting satellite for which the instrument was designed. A description of MOCS is presented and the data reduction methods are discussed. The investigation shows that remote sensing with spectrometric techniques from high altitudes can provide a means of detecting small variations in water content, involving chlorophyll, particulates, and pollution. G.R.

A74-21472 Remote measurements of sea surface wind velocity. K. J. Petri and R. F. Starry (U.S. Naval Material Command, Naval Air Development Center, Warminster, Pa.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 641-663. 8 refs. Navy-supported research.

A 1.06 micron CW laser radar system was used to establish the feasibility of remotely measuring sea surface wind magnitude and direction. Experiments were conducted from the NRL (Naval Research Laboratory) Chesapeake Bay Bridge Facility, Annapolis, Maryland. Simultaneous correlation of the collected laser data with the environment was established using meteorological instruments. The experimental system and methods of analysis are summarized. Results of the experiments including wind magnitude and direction correlation are reported. Results are compared with theoretical predictions. (Author)

A74-21473 * Distribution pattern of temperature and bio-mass in the upwelling area along the NW coast of Africa. K.-H. Szekielda (Delaware, University, Newark, Del.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 664-716. 25 refs. Contract No. NAS5-21784.

Atmospheric conditions and wind systems are considered together with temperature observations. Data from scanning radiometers in the infrared and television cameras for the visible were applied to derive temperature data over cloudfree regions. From the analyzed spacecraft data it is obvious that the distribution of temperature and nonconservative parameters is much more complicated than one might expect from conventional measurements onboard a ship. G.R.

A74-21474 On the nearshore circulation of the Gulf of Carpentaria, Australia - A study in uses of satellite imagery /ERTS/ in remotely accessible areas. P. G. Teleki (U.S. Army, Coastal Engineering Research Center, Fort Belvoir, Va.), G. A. Rabchevsky (Terratek, Inc., Lanham, Md.), and J. W. White (Photo Science, Inc., Gaithersburg, Md.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 717-736. 12 refs.

A74-21475 Prediction models for correlation of laser sea return with the wind profile. W. Marks (Poseidon Scientific Corp., Dix Hills, N.Y.) and R. A. Stacy (City College, Bronx, N.Y.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 737-759. 47 refs. Navy-supported research.

The investigation reported shows that theories involving radar backscatter cannot be used to describe laser return because there is no clear one-to-one relationship between radar cross section and laser cross section. An extension of the Jackson (1972) model is only limited by the elevation angle. This approach provides, therefore, the most general laser theory available. The theory due to Jackson results in three forms of normalized isotropic laser cross section. Swennen's (1965) and Jackson's models, after modification and extension, produce five wind predictors worthy of evaluation. G.R.

A74-21476 The feasibility of ocean current mapping via synthetic aperture radar methods. L. I. Moskowitz (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 760-771. 7 refs.

An airborne experiment was conducted in February 1973 whereby application of radar to remote sensing oceanography was extended to include locating and mapping the north wall of the Gulf Stream. Operating from a Naval Research Laboratory C-121, L- and X-Band side looking imagery was obtained. Several samples of the imagery will be presented. The north wall exhibited three parallel lineations instead of the more normal single demarcation zone. The results of the experiment have shown conclusively the feasibility of utilizing synthetic aperture radar for detecting and mapping oceanic current boundaries such as the north wall of the Gulf Stream.

(Author)

A74-21477 A study of oceanic mixing with dyes and multispectral photogrammetry. P. G. Teleki, D. A. Prins (U.S. Army, Coastal Engineering Research Center, Fort Belvoir, Va.), and J. W. White (Photo Science, Inc., Gaithersburg, Md.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 772-787. 13 refs.

The possibility of studying coastal currents and turbulent mixing by remote sensing is investigated. In mixed regions it is essential to identify the sources of constituent water masses, their rate of propagation and discharge. The spectral responses of water tracing dyes to various film-filter combinations were investigated under field and laboratory conditions. Preliminary results indicate that conservative tracers which are spectrally stable can be recorded isolated from others in b&w multispectral imagery, and can also be reconstructed in color composites, providing a label for water masses of varying origin. (Author)

A74-21479 A comparison of interpretation and photogrammetric methods for delimiting the mean high water position on a tropical beach. J. P. Latham (Florida Atlantic University, Boca Raton, Fla.). In: American Society of Photogrammetry, Fall Conven-

tion, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 803-818.

A74-21481 * Transmissometry and suspended matter in lower Chesapeake Bay - Correlation with ERTS multispectral imagery. D. E. Bowker (NASA, Langley Research Center, Hampton, Va.), P. Fleischer, T. A. Gosink, W. J. Hanna (Old Dominion University, Norfolk, Va.), and J. C. Ludwick. In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 840-847.

The use of multispectral imagery from the Earth Resources Technology Satellite to quantitatively monitor turbidity and suspended matter of estuarine waters is being evaluated in this study. Synoptic measurements of surface-water characteristics are being made on three baselines in lower Chesapeake Bay in synchrony with satellite overpasses. Turbidity is measured as transmittance by a continuously recording transmissometer, and suspended matter is collected by filtration. Preliminary correlations to ERTS multispectral imagery have been made by microdensitometry. Final correlations will be made from the bulk tape format. (Author)

A74-21482 * Satellite studies of turbidity and circulation patterns in Delaware Bay. V. Klemas, R. Srna, W. M. Treasure (Delaware University, Newark, Del.), and R. Rogers (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 848-871. 14 refs. Contracts No. N00014-69-A-0407; No. NAS5-21837.

Satellite imagery from four successful ERTS-1 passes over Delaware Bay during different portions of the tidal cycle are interpreted with special emphasis on visibility of suspended sediment and its use as a natural tracer for gross circulation patterns. The MSS red band (band 5) appears to give the best contrast, although the sediment patterns are represented by only a few neighboring shades of grey. Color density slicing improves the differentiation of turbidity levels. However, color additive enhancements are of limited value since most of the information is in a single color band. The ability of ERTS-1 to present a synoptic view of the surface circulation over the entire bay is shown to be a valuable and unique contribution of ERTS-1 to coastal oceanography. (Author)

A74-21483 ERTS studies of Alaskan coastal circulation. F. F. Wright (Alaska University, Anchorage, Alaska) and G. D. Sharma (Alaska University, Fairbanks, Alaska). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 872-882, 1055. 7 refs.

Oceanographic investigations in Cook Inlet are discussed, giving attention to the relations between the oceanographic parameters and the ERTS-imagery of various bands. It is suggested that the distribution of turbid waters registered on ERTS imagery can be an effective tool to delineate general oceanographic circulation, major coastal sources for sediments, and sediment distribution patterns.

G.R.

A74-21491 * Radar signal return from near-shore surface and shallow subsurface features, Darien Province, Panama. B. C. Hanson and L. F. Dellwig (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 1017-1031. Contract No. NAS9-10261.

A74-21492 Aerial photographic sensing of pelagic fish schools - A comparison of two films. J. A. Benigno (NOAA, National Marine Fisheries Service, Pascagoula, Miss.) and A. J. Kemmerer (NOAA, National Marine Fisheries Service, Washington, D.C.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2.

Falls Church, Va., American Society of Photogrammetry, 1973, p. 1032-1040. 6 refs.

A relatively new aerial film, GAF-1000 blue insensitive color film (type 2575) designed for water penetration, was compared with Kodak aerochrome infrared film (type 2443) for detection of surface and near-surface schooling Gulf menhaden in the Mississippi Sound. The comparison showed that the infrared film was superior to the blue insensitive film for fish detection. An examination of the unique properties of each film indicated that the difference may be due to the sensitivity of the GAF film in the blue-violet region of the light spectrum and its lack of sensitivity in the near-infrared portion of the spectrum, an area where menhaden are highly reflective. T.M.

A74-22100 # The French-Australian satellite-buoy experiment. G. R. Cresswell (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). *Australian Meteorological Magazine*, vol. 21, Mar. 1973, p. 1-17. 7 refs.

The design, testing, and deployment of a prototype fiberglass spar buoy to carry an 'EOLE' satellite transponder for ocean current and environmental measurements is described. The buoy with a drogue at 30 m depth was released in the East Australian Current and transponded to the satellite for 33 days, travelling 1400 km in a meandering path that took it 600 km eastward. The path of the buoy, in general, agrees with qualitative current estimates from aircraft I-R data, ship expendable bathythermograph data, and ship sea surface temperature data. The buoy, minus its drogue, drifted ashore after 4 months. (Author)

A74-22269 # Measurement of sea swell parameters by a radio method from a flight vehicle (Izmerenie parametrov morskogo volneniia radiotekhnicheskimi metodami s letatel'nogo apparata). A. A. Garnaker'ian, K. L. Afanas'ev, V. T. Lobach, and V. V. Timonov (Taganrogskii Radiotekhnicheskii Institut, Taganrog, USSR). *Meteorologiya i Gidrologiya*, Dec. 1973, p. 102-108. 10 refs. In Russian.

A74-24057 Sea ice-motions off Antarctica in the vicinity of the Eastern Ross Sea as observed by satellite. R. J. DeRycke (NOAA, National Environmental Satellite Service, Washington, D.C.). *Journal of Geophysical Research*, vol. 78, Dec. 20, 1973, p. 8873-8879. 5 refs.

A74-24257 # Observational studies of mesoscale cellular convection. E. M. Agee and K. E. Dowell (Purdue University, West Lafayette, Ind.). *Journal of Applied Meteorology*, vol. 13, Feb. 1974, p. 46-53. 12 refs. NSF Grant No. GA-24136A2.

An observational study of mesoscale cellular convection occurring over vast regions of the North Atlantic and North Pacific has been done for the period from Jan. 1, 1969, through June 30, 1970. Satellite cloud photography from the ESSA 7, ESSA 9, and ATS 3 satellites and conventional rawinsonde data have been analyzed for a total of 38 cases, consisting of 25 open and 13 closed convective patterns. Computations have shown that: (1) the average diameter is 30 km for open cells and 32 km for closed cells; (2) the average convective depth for open cells is 2.3 km, greater than the 1.3 km average for closed cells; (3) the average aspect (diameter-to-depth) ratio for open cells, 15:1, is less than that for closed cells, 28:1; (4) the aspect ratio is inversely proportional to increasing convective depth; (5) sea surface temperature exceeds the air temperature on the average by 2.1C in open cells but is 0.4 C less in closed cells; and (6) directional and magnitude shear (in the vertical) of the horizontal

wind is small, less than 7 deg per km and 2 m per sec per km, respectively, but indicative of backing cold air advection in open cells and veering or warm air advection in closed cells. (Author)

A74-24966 * Earth and Ocean Physics Applications Program /EOPAP/. F. O. Vonbun (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Astronautical research 1972; Proceedings of the Twenty-third Congress, Vienna, Austria, October 8-15, 1972.

Dordrecht, D. Reidel Publishing Co., 1973, p. 239-245.

Abbreviated description of the objectives, experiments, spacecraft, and required schedules of a proposed NASA program blending geophysics, oceanography, and space technology in order to facilitate the prediction of earthquakes, storm surges, tidal waves, and the condition of ocean surfaces. Relevant measurements from space will be carried out by LAGEOS, SAESATS-1, GEOPAUSE, GRAVSAT, and SEASATS-2 satellites contributing data on earth dynamics, sea surface states, satellite dynamics, and earth gravity. The development of suitable mathematical models for predicting events on earth on the basis of satellite data is considered. T.M.

A74-25053 Directional spectra of surface waves from photographs. D. Stilwell, Jr. and R. O. Pilon (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Journal of Geophysical Research*, vol. 79, Mar. 20, 1974, p. 1277-1284. 9 refs.

A method is developed in which the spectrum of ocean surface waves may be deduced from oblique photographs. The method consists of determining the change of surface brightness with variations of surface slope and measuring the diffraction pattern of the photographic negative. The diffraction pattern, obtained by a coherent optical processor, is then related to the two-dimensional wave number spectrum of the sea surface photographed. The conditions under which the optically derived spectrum is an accurate estimator of the ocean spectrum are discussed. The experimental method is applied to a nonstationary wave field exhibiting anomalously large spectral magnitudes. The two-dimensional spectrum of this wave field is displayed over a wavelength range of from 5 to 20 cm and an azimuth interval of about 90 deg. (Author)

A74-25416 * Near nadir radar cross section of the ocean surface. K. Tomiyasu (General Electric Co., Philadelphia, Pa.) and W. L. Jones (NASA, Langley Research Center, Hampton, Va.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 521-527. 12 refs. Contract No. NAS1-10161.

A74-25458 Seasonal aspects of remote sensing coastal resources. D. E. Thompson, J. E. Ragsdale, Jr. (MAPCOtec, Inc., Daytona Beach, Fla.), R. J. Reimold, and J. L. Gallagher (Georgia, University, Sapelo Island, Ga.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1201-1249. 30 refs. NSF Grant No. GA-29446.

The application of remote sensing technology to environmental problems in the southeastern coastal zone was studied on the Georgia coast where missions were flown six times during the year. The effect of season and meteorological variables was considered in relation to information needed from the remote sensing missions. Coastal resources including the highly productive salt marshes; shell and sand deposits; timber; and water were evaluated via remote sensors using aerial color, color infrared, black and white, and black and white infrared photography and infrared scanning imagery. Impact problems related to highway location, dredge spoil placement,

industrial and recreational development were considered in light of 'remote sensed' information acquired at various seasons. The effects of the seasonal aspects on acquisition cost, as well as the success of collecting comprehensive scientific information, were examined.

(Author)

A74-26007 # Heat and moisture budget analyses using BOMEX data. T. Nitta and S. Esbensen (California, University, Los Angeles, Calif.). *Monthly Weather Review*, vol. 102, Jan. 1974, p. 17-28. 21 refs. NSF Grant No. GA-31694.

Large-scale heat and moisture budgets over the tropical Atlantic Ocean are examined during Phase 3 (June 22 to 30, 1969) of the Barbados Oceanographic and Meteorological Experiment. From the satellite cloud photographs of ATS-3, the analyzed period is subdivided into an undisturbed part and a disturbed part. During the undisturbed period, downward motion predominates from the surface to about 500 mb and a large apparent heat sink and apparent moisture source are found near the top of the trade inversion layer. The upward heat flux due to cumulus clouds is confined below the 700-mb level. On the other hand, during the relatively disturbed period, upward motion takes place at low levels and the heat flux due to cumulus convection extends to at least 500 mb. Values of the total heat flux estimated by large-scale budgets agree well with those obtained independently by bulk aerodynamic computations.

(Author)

A74-26866 # The components of the spatial spectrum of a radar signal scattered by a sea surface (O sostavliayushchikh prostranstvennogo spektra radiolokatsionnogo signala, rasseiannogo morskoi poverkhnost'iu). A. A. Zagorodnikov. *Radiotekhnika i Elektronika*, vol. 19, Feb. 1974, p. 419-421. 12 refs. In Russian.

Analysis of the spectrum of the envelope of a radar signal which represents the spatial characteristics of an underlying sea surface. It is shown that the reflecting surface of the sea can be represented in the form of a set of independent random reflectors, as a result of which the spectral density of the fine ripples (which cause centimeter range signal reflection) on the slopes of the large waves can be neglected in calculations of the spatial characteristics of the signal. A.B.K.

A74-26884 Detection of turbidity dynamics in Tampa Bay, Florida using multispectral imagery from ERTS-1. A. E. Coker, A. Higer (U.S. Geological Survey, Tampa, Fla.), and C. R. Goodwin (U.S. Geological Survey, Miami, Fla.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 139-146.

In 1970, Congress authorized the deepening of the Tampa Bay channel (Rivers and Harbors Act of 1970) from 34 to 44 feet. In order to determine the effects of this deepening on circulation, water quality, and biota, during and after the construction, the U.S. Geological Survey, in cooperation with the Tampa Port Authority, has collected data and developed a digital simulation model of the bay. In addition to data collected using conventional tools, use is being made of data collected from ERTS-1. Return-Beam Vidicon multispectral data were collected, while a shell dredging barge was operating in the bay, and used for turbidity recognition and unique spectral signatures representative of type and amount of material in suspension. The processed data integrated with other modeled parameters provide an overview of the dynamics of turbid material during dredging periods.

(Author)

A74-26894 Applications of multicolor dye tracers and multispectral photography to coastal water mapping. D. T. Hodder (Rockwell International Corp., Downey, Calif.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p.

247-258. Navy-supported research.

A new concept has evolved for investigation of the morphology and three-dimensional transport of turbidity cells. The basic idea is to make use of the variable extinction (water penetration) depths for different narrow bandwidths (plus or minus 100 Å) of the image forming light scattered through relatively turbid waters, and the corresponding instrumental narrow band slicing of the visible spectrum feasible with interference filters. The method of employing these phenomena and multiband imaging techniques is to make a multicolored dye release of dyes with different characteristic spectral signatures as viewed with narrow band (interference) filters. These releases are made at depths which match the extinction depths for light within the respective dye characteristic signature bandwidths.

(Author)

A74-26895 * Four wavelength lidar applied to determination of chlorophyll a concentration and algae color group. O. Jarrett, Jr., P. B. Mumola, and C. A. Brown, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 259-268. 12 refs.

A technique for remote measurement of chlorophyll a density and determination of algae color group is described. In vivo fluorescence measurements of chlorophyll a for four color groups of algae (green, golden-brown, red, and blue-green) are described, and representative spectra are shown. The lidar equation is developed for the general case of a mixture of color groups showing the need for multicolor excitation. The lidar instrument which has been designed and fabricated at Langley Research Center for helicopter flights over surrounding portions of the Chesapeake Bay is described. The lidar package contains a unique four-color dye laser which permits multicolor excitation of chlorophyll a fluorescence from the various color groups of algae.

(Author)

N74-16008* # Arizona Univ. Tucson. Dept. of Biological Sciences.

STUDY OF THE MARINE ENVIRONMENT OF THE NORTHERN GULF OF CALIFORNIA Final Report, 21 Jun. 1972 - 19 Sep. 1973

John R. Hendrickson, Principal Investigator 19 Oct. 1973 128 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-21777)

(E74-10246; NASA-CR-136544) Avail: NTIS HC \$8.50 CSCL 08A

The author has identified the following significant results. Results of studies of the oceanography of the northern Gulf of California (Mexico) are reported. A remote, instrumented buoy measuring and telemetering oceanographic data by ERTS-1 satellite was designed, constructed, deployed, and tested. Regular cruises by a research ship on a pattern of 47 oceanographic stations collected data which are analyzed and referenced to analysis of ERTS-1 satellite imagery. A thermal dynamic model of current patterns in the northern Gulf of California is proposed. Findings are examined in relation to the model.

N74-16024* # National Marine Fisheries Service, Bay Saint Louis, Miss.

APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Jan. - 10 Feb. 1974

William H. Stevenson, Principal Investigator 8 Feb. 1974 4 p EREP

(NASA Order T-8217-B) (E74-10263; NASA-CR-136648; MPR-9) Avail: NTIS HC \$3.00 CSCL 08A

N74-16029*# National Environmental Satellite Service, Washington, D.C.

EVALUATION OF ERTS DATA FOR CERTAIN OCEANOGRAPHIC USES Bimonthly Report, Nov. - Dec. 1973

Alan E. Strong, Principal Investigator Dec. 1973 3 p ERTS (NASA Order S-70246-AG)

(E74-10287; NASA-CR-136673) Avail: NTIS HC \$3.00 CSCL 08H

The author has identified the following significant results. Upwelling along the eastern shore of Lake Michigan was occurring during the 3 and 21 August 1973 visits by ERTS-1. The NOAA-2 VHR thermal-IR data are being digitized for comparison. Early indications are that these upwellings induced a calcium carbonate precipitate to form in the surface waters. It is most pronounced in the MSS-4 channel. On the lake bottom this jelly-like sediment is known as marl and adds to the eutrophication of the lake. This phenomenon may help to explain the varve-like nature of bottom cores that have been observed in the Great Lakes.

N74-16065*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

MISSISSIPPI SOUND REMOTE SENSING STUDY

B. H. Atwell Apr. 1973 75 p refs Original contains color illustrations

(NASA-TM-X-69783; ERL-048) Avail: NTIS HC \$5.75 CSCL 08H

The Mississippi Sound Remote Sensing Study was initiated as part of the research program of the NASA Earth Resources Laboratory. The objective of this study is development of remote sensing techniques to study near-shore marine waters. Included within this general objective are the following: (1) evaluate existing techniques and instruments used for remote measurement of parameters of interest within these waters; (2) develop methods for interpretation of state-of-the-art remote sensing data which are most meaningful to an understanding of processes taking place within near-shore waters; (3) define hardware development requirements and/or system specifications; (4) develop a system combining data from remote and surface measurements which will most efficiently assess conditions in near-shore waters; (5) conduct projects in coordination with appropriate operating agencies to demonstrate applicability of this research to environmental and economic problems. Author

N74-16066*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

REMOTE MEASUREMENT OF SALINITY: REPEATED MEASUREMENTS OVER A SINGLE FLIGHT LINE NEAR THE MISSISSIPPI SOUND

Gary C. Thomann Aug. 1973 14 p refs

(NASA-TM-X-69782; ERL-079) Avail: NTIS HC \$3.00 CSCL 08J

Experiments to remotely determine sea water salinity from measurements of the sea surface radiometric temperature over the Mississippi Sound were conducted. The line was flown six times at an altitude of 244 meters. The radiometric temperature of the sea surface was measured in two spectral intervals. The specifications of the equipment and the conditions under which the tests were conducted are described. Results of the tests are presented in the form of graphs. Author

N74-16067*# National Aeronautics and Space Administration, Mississippi Test Facility, Bay Saint Louis.

REMOTE MEASUREMENT OF WATER COLOR IN COASTAL WATERS

J. W. Weldon Aug. 1973 57 p refs

(NASA-TM-X-69784; RERL-083) Avail: NTIS HC \$5.00 CSCL 08J

An investigation was conducted to develop procedure to obtain quantitative values for chlorophyll and turbidity in coastal waters by observing the changes in spectral radiance of the backscattered spectrum. The technique under consideration consists of Examining Exotech model 20-D spectral radiometer data and determining which radiance ratios best correlated with chlorophyll and turbidity measurements as obtained from analyses

of water samples and sechi visibility readings. Preliminary results indicate that there is a correlation between backscattered light and chlorophyll concentration and sechi visibility. The tests were conducted with the spectrometer mounted in a light aircraft over the Mississippi Sound at altitudes of 2.5K, 2.8K and 10K feet.

Author

N74-16080# DBA Systems, Inc., Melbourne, Fla.

INVESTIGATION OF THE FEASIBILITY OF A SHORT ARC REDUCTION OF SATELLITE ALTIMETRY FOR DETERMINATION OF THE OCEANIC GEOID Final Report, Jan. 1972 - Aug. 1973

Duane C. Brown Aug. 1973 59 p refs

(Contract F19628-72-C-0085; AF Proj. 8607)

(AD-768971; AFCRL-TR-73-0520) Avail: NTIS CSCL 08/5

A short arc approach to the determination of the oceanic geoid from observations made by a satellite-borne radar altimeter entails the recovery of geoidal parameters simultaneously with the recovery of weakly constrained orbital state vectors defining a very large number (i.e., thousands) of independent, interlocking short arcs (arcs typically 1/6 to 1/8 revolution in length). Patterned characteristics of the normal equations make such a simultaneous solution possible, no matter how many sets of orbital parameters are to be recovered. Computer simulations demonstrate that the approach is strongly determinate and can reasonably be expected to produce an oceanic geoid having an rms accuracy approaching one meter from the reduction of GEOS C observations. The major advantage offered by the short arc approach is that it in no way depends on the establishment of a highly accurate reference orbit and thus places only minimal requirements on satellite tracking by external systems. An additional advantage is that observational residuals can be expected to be relatively uncompromised by orbital biases. (Modified author abstract)

GRA

N74-16089# Naval Research Lab., Washington, D.C.

THE WAVE SPECTRUM AND WINDSPEED AS DESCRIPTORS OF THE OCEAN SURFACE Final Report

Lionel T. Moskowitz 30 Oct. 1973 16 p refs

(RF12151402)

(AD-769669; NRL-7626) Avail: NTIS CSCL 08/3

Of the various parameters and phenomena used in describing sea surface conditions, the two most widely used are the wave spectrum and the windspeed. The wave spectrum states how the surface wave energy is distributed with wave frequency. The windspeed is the key parameter for allowing an estimate of the wave spectrum to be made where it is otherwise unobtainable. Remote sensing techniques have been developed to help describe what is occurring at the sea-air interface. In this report the wave spectrum concept is discussed briefly and a systematic approach is taken to describe various ways by which windspeeds at sea are determined. The various techniques for determining windspeeds at sea can be classified in three categories: (a) direct measurements from instrumented platforms, (b) estimates from noninstrumented platforms, and (c) estimates inferred from other data. Such a classification serves to document systematic errors associated with various methods of obtaining windspeed observations. (Modified author abstract)

GRA

N74-16325*# Environmental Research and Technology, Inc., Lexington, Mass.

ANALYSIS OF AIRCRAFT MICROWAVE MEASUREMENTS OF THE OCEAN SURFACE Final Report, Aug. 1972 - 4 Aug. 1973

James H. Willand, Mary Grace Fowler, Edward C. Reifenstein, III, and David T. Chang Dec. 1973 185 p refs

(Contract NAS5-21828)

(NASA-CR-132923; P-442) Avail: NTIS HC \$11.25 CSCL 04B

A data system was developed to process, from calibrated brightness temperature to computation of estimated parameters, the microwave measurements obtained by the NASA CV-990 aircraft during the 1972 Meteorological Expedition. A primary objective of the study was the implementation of an integrated

software system at the computing facility of NASA/GSFC, and its application to the 1972 data. A single test case involving measurements away from and over a heavy rain cell was chosen to examine the effect of clouds upon the ability to infer ocean surface parameters. The results indicate substantial agreement with those of the theoretical study; namely, that the values obtained for the surface properties are consistent with available ground-truth information, and are reproducible except within the heaviest portions of the rain cell, at which nonlinear (or saturation) effects become apparent. Finally, it is seen that uncorrected instrumental effects introduce systematic errors which may limit the accuracy of the method. Author

N74-17072*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs. **REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER** Monthly Progress Report, Jan. 1974
George A. Maul, Principal Investigator Jan. 1974 3 p EREP (NASA Order T-4713-B)
(E74-10280; NASA-CR-136666; MPR-7) Avail: NTIS HC \$3.00 CSCL 08C

N74-17082*# Alaska Univ., Fairbanks. Inst. of Marine Science. **THE CIRCULATION OF PRINCE WILLIAM SOUND** Bi-monthly Progress Report
Robin D. Muench, Principal Investigator 31 Jan. 1974 2 p ERTS
(Contract NAS5-21833)
(E74-10293; NASA-CR-136680; BMPR-9) Avail: NTIS HC \$3.00 CSCL 08H

N74-17093*# Army Engineer Waterways Experiment Station, Vicksburg, Miss. 08H **MAPPING SUSPENDED PARTICLE AND SOLUTE CONCENTRATIONS FROM SATELLITE DATA**
Warren E. Grabau, Principal Investigator and A. N. Williamson 4 Feb. 1974 33 p Presented at the ASCE Natl. Water Resources Eng. Meeting, Los Angeles, 21-25 Jan. 1974 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70259-AG)
(E74-10304; NASA-CR-136786) Avail: NTIS HC \$4.75

N74-17104*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs. **REMOTE SENSING OF OCEAN CURRENTS** Bimonthly Report, 4 Nov. 1973 - 4 Jan. 1974
George A. Maul, Principal Investigator 4 Jan. 1974 32 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG)
(E74-10319; NASA-CR-136808) Avail: NTIS HC \$4.75 CSCL 08C

The author has identified the following significant results. A time series of the Loop Current in the Gulf of Mexico, covering an annual cycle of growth, spreading, and decay, has been obtained in synchronization with ERTS-1. Computer enhanced images, which are necessary to extract useful oceanic information, show that the current can be observed either by color or sea state effects associated with the cyclonic boundary. The color effect relates to the spectral variations in the optical properties of the water and its suspended particles, and is studied by radiative transfer theory. Significant oceanic parameters identified are: the probability of forward scattering, and the ratio of scattering to total attenuation. Several spectra of upwelling diffuse light are computed as a function of the concentration of particles and

yellow substance. These calculations compare favorably with experimental measurements and show that the ratio of channels method gives ambiguous interpretative results. These results are used to discuss features in images where surface measurements were obtained and are extended to tentative explanation in others.

N74-17115*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. **OCEAN COLOR SPECTRUM CALCULATIONS**
W. R. McCluney Feb. 1974 39 p refs Submitted for publication
(NASA-TM-X-70594; X-913-74-53) Avail: NTIS HC \$5.00 CSCL 08J

The development is considered of procedures for measuring a number of subsurface oceanographic parameters using remotely sensed ocean color data. It is proposed that the first step in this effort should be the development of adequate theoretical models relating the desired oceanographic parameters to the upwelling radiances to be observed. A portion of a contributory theoretical model is shown to be described by a modified single scattering approach based upon a simple treatment of multiple scattering. The resulting quasi-single scattering model can be used to predict the upwelling distribution of spectral radiance emerging from the sea. The shape of the radiance spectrum predicted by this model for clear ocean water shows encouraging agreement with measurements made at the edge of the Sargasso Sea off Cape Hatteras. Author

N74-17343# World Meteorological Organization, Geneva (Switzerland). International Commission of Polar Meteorology. **ENERGY FLUXES OVER POLAR SURFACES**
Svenn Orvig, ed. 1973 307 p refs Proc. of Intern. Assoc. of Meteorol. and Atmospheric Phys./Intern. Assoc. of the Phys. of Sci. of the Ocean/Sci. Comm. on Antarctic Res./WMO Symp., Moscow, 3-5 Aug. 1971
(WMO-361; TN-129) Avail: NTIS HC \$18.50; WMO, Geneva

Polar meteorological studies on energy fluxes in arctic and antarctic regions are presented. Topics include energy fluxes over land surfaces and over sea ice, wind studies, regional and global studies on large-scale energy fluxes, and interaction between ocean and atmosphere.

N74-17357 Anticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad (USSR). **ELECTROMAGNETIC AND OPTIC CHARACTERISTICS OF SEA ICE**
V. V. Bogorodsky, B. Y. Gaytskhokiy, and V. I. Tripolnikov In WMO Energy Fluxes over Polar Surfaces 1973 p 281-299 refs

Physical processes of ocean and atmospheric interaction under Arctic conditions depend on the state of the ice cover. Such factors as ice concentration, ice thickness, and elastic properties of ice exert influence on the mechanical aspects of the interaction; besides these factors the heat exchange is influenced by ice temperature, heat conductivity, spectral ice, and snow transparency. Remote methods of measurement of sea ice are discussed and as well as a photometric model of ice and snow-ice cover. Spectral values of the coefficients of diffuse transmission are shown. The described approach to the solution of the problem of optical radiation transfer through the snow-ice cover may give quite satisfactory results for a number of practical tasks. Author (ESRO)

N74-18004*# National Marine Fisheries Service, Bay Saint Louis, Miss. **APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING** Monthly Progress Report, 10 Nov. - 10 Dec. 1973
Kenneth Savastano, Principal Investigator 5 Dec. 1973 5 p EREP
(NASA Order T-8217-B)
(E74-10328; NASA-CR-136823; MPR-7) Avail: NTIS HC \$4.00

N74-18008*# National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.

INVESTIGATION USING DATA FROM ERTS-1 TO DEVELOP AND IMPLEMENT UTILIZATION OF LIVING MARINE RESOURCES Final Report, 1 Jul. 1972 - 4 Oct. 1973

William H. Stevenson, Principal Investigator and E. J. Pastula, Jr. Dec. 1973 198 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70246-AG)

(E74-10332; NASA-CR-136843) Avail: NTIS HC\$13.00 CSCL 08A

The author has identified the following significant results. This 15-month ERTS-1 investigation produced correlations between satellite, aircraft, menhaden fisheries, and environmental sea truth data from the Mississippi Sound. Selected oceanographic, meteorological, and biological parameters were used as indirect indicators of the menhaden resource. Synoptic and near real time sea truth, fishery, satellite imagery, aircraft acquired multispectral, photo and thermal IR information were acquired as data inputs. Computer programs were developed to manipulate these data according to user requirements. Preliminary results indicate a correlation between backscattered light with chlorophyll concentration and water transparency in turbid waters. Eight empirical menhaden distribution models were constructed from combinations of four fisheries-significant oceanographic parameters: water depth, transparency, color, and surface salinity. The models demonstrated their potential for management utilization in areas of resource assessment, prediction, and monitoring.

N74-18014*# National Marine Fisheries Service, Bay Saint Louis, Miss.

APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Jul. - 10 Aug. 1973

Kenneth Savastano and William H. Stevenson, Principal Investigators 14 Aug. 1973 5 p EREP (NASA Order T-8217-B)

(E74-10338; NASA-CR-136849; MPR-3) Avail: NTIS HC \$4.00 CSCL 08A

N74-18016*# Research Triangle Inst., Research Triangle Park, N.C.

[RADAR BACKSCATTERING AS A MEANS FOR MEASURING OCEAN SURFACE PARAMETERS USING S193 ALTIMETRY AND S190B PHOTOGRAPHY] Monthly Progress Report, 1-31 Aug. 1973

Lee S. Miller and Gary S. Brown, Principal Investigators 12 Sep. 1973 2 p EREP

(Contract NAS9-13304)

(E74-10340; NASA-CR-136852) Avail: NTIS HC \$4.00 CSCL 08J

N74-18020*# Naval Oceanographic Office, Washington, D.C. **EARTH RESOURCES TECHNOLOGY SATELLITE DRIFT BUOY PROGRAM Final Report**

Robert Kee, Principal Investigator 21 Jan. 1974 13 p ERTS (NASA Order S-70262-AG)

(E74-10344; NASA-CR-136856) Avail: NTIS HC \$4.00 CSCL 08C

N74-18022*# Delaware Univ., Newark. Coll. of Marine Studies.

COMPARISON OF ERTS-1 AND SKYLAB-EREP FOR INTERDISCIPLINARY COASTAL INVESTIGATIONS Report on Significant Results.

V. Klemas, Principal Investigator and D. Bartlett 12 Mar. 1974 2 p ERTS

(Contract NAS5-21837)

(E74-10347; NASA-CR-136859) Avail: NTIS HC \$4.00 CSCL 08C

The author has identified the following significant results. NASA's ERTS-1 satellite and Skylab EREP have both provided imagery suitable for investigating coastal vegetation, land use, current circulation, water turbidity, waste disposal, and sea state. Based on high contrast targets, such as piers and breakwaters, the ERTS-1 MSS seems to have a resolution of 70-100 meters, Skylab's S190A about 30-70 meters, and its S190B about 10-30 meters. Important coastal land use details can be more readily mapped using Skylab's imagery. On the other hand, the regular eighteen day cycle of ERTS-1 allows observation of important manmade and natural changes, and facilitates collection of ground truth. The Skylab/EREP multispectral scanner offers 13 spectral bands as compared to 4 bands on ERTS-1. However, EREP scanner tapes require special filtering to remove several types of noise and their conical line scan pattern must be linearized before one can identify small targets based on spatial features.

N74-18079# Stanford Research Inst., Menlo Park, Calif. **SCATTERING OF LASER RADIATION FROM THE OCEAN SURFACE Technical Report, 23 Apr. - 31 Aug. 1973**

Kamala S. Krishnan and Norman A. Peppers Oct. 1973 104 p refs

(Contract N00014-73-C-0445; ARPA Order 2185)

(AD-772122) Avail: NTIS CSCL 20/6

The theory of speckle patterns from diffusely scattered coherent light was examined and extended to apply to scattering by the surface of the sea. It was determined that the surface characteristics can be related to the ensemble average power spectral density of the scattered radiation. However, since measurement of the latter quantity is difficult, it would be more practical to measure the ensemble average scattered intensity distribution. It turns out that the expression obtained for that distribution is similar to that for high frequency radar backscatter.

GRA

N74-18963*# National Marine Fisheries Service, Bay Saint Louis, Miss.

APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 10 Feb. - 10 Mar. 1974

Kenneth J. Savastano, Principal Investigator 11 Mar. 1974 4 p EREP

(Contract NASA Order T-8217-B)

(E74-10354; NASA-CR-137039; MPR-10) Avail: NTIS HC \$4.00 CSCL 08A

N74-18977*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs. **REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Report, Feb. 1974**

George A. Maul, Principal Investigator Feb. 1974 3 p EREP (NASA Order T-4713-B)

(E74-10368; NASA-CR-137062; MPR-8) Avail: NTIS HC \$4.00 CSCL 08J

N74-19004*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.

IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND OCEANOGRAPHY OF BLOCK ISLAND SOUND Monthly Progress Report, Mar. 1974

E. Yost, Principal Investigator 20 Mar. 1974 4 p EREP

(Contract NAS9-13308)

(E74-10396; NASA-CR-137214) Avail: NTIS HC \$4.00 CSCL 08J

05 OCEANOGRAPHY AND MARINE RESOURCES

N74-19007*# Science Applications, Inc., Ann Arbor, Mich.
USE OF SKYLAB EREP DATA IN A SEA SURFACE TEMPERATURE EXPERIMENT Quarterly Report, 17 Nov. 1973 - 17 Feb. 1974
David C. Anding, Principal Investigator and John P. Walker Feb. 1974 31 p refs EREP
(Contract NAS9-13277)
(E74-10399; NASA-CR-137224; JRB-74-201-AA; QR-4) Avail: NTIS HC \$4.75 CSCL 08J

N74-19070# Delaware Univ., Newark.
RESEARCH IN THE COASTAL AND OCEANIC ENVIRONMENT Annual Status Report, 1 Sep. 1972 - 31 Aug. 1973
William S. Gaither and Vytautas Klemas Nov. 1973 35 p refs
(Contract N00014-69-A-0407; NR Proj. 388-096)
(AD-772104; TR-25) Avail: NTIS CSCL 08/3

Progress during the fourth year of a multi-disciplinary study of a section of the Atlantic seacoast (Delaware and adjacent areas of New Jersey and Maryland) is summarized. Models of coastal processes have been developed to aid in the analysis of coastal environments and for use in making precise short-term prediction of coastal change by means of intensive analysis of the near past historic records and sequence of geologic events. Continued theoretical investigations of wave action, model studies of sedimentary processes, and the results of additional observations of vegetative growth and of surface energy exchanges are reported. Two-dimensional optical spectral analysis of shallow water waves is discussed and other remote sensing results are summarized, with emphasis on frontal systems, suspended sediment and flow patterns in and outside Delaware Bay.

Author (GRA)

N74-20957*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SEDIMENT PATTERN CORRELATION WITH INFLOW AND TIDAL ACTION Progress Report, 1 Jan. - 28 Feb. 1974
Warren E. Grabau, Principal Investigator 28 Feb. 1974 2 p refs ERTS
(NASA Order S-70259-AG)
(E74-10430; NASA-CR-137377) Avail: NTIS HC \$4.00 CSCL 08C

N74-21274 Joint Publications Research Service, Arlington, Va.
MEASURING THE SEA WAVE PARAMETERS BY THE RADIOTECHNICAL METHOD FROM AN AIRCRAFT OR SPACECRAFT c13
A. A. Garnakeryan, K. L. Afanasyev, V. T. Lobach, and V. V. Timonov *In its Meteorol. and Hydrol.*, No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 134-143 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 102-108

The heights of sea waves are determined from an aircraft or spacecraft by measuring the ratio of the incoherent component to the coherent component in the reflected radio-echo in the meter range of radio waves. It is experimentally demonstrated that it is possible to measure the length and direction of sea wave propagation by the spectral correlation characteristics of the echo.

Author

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers. saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A74-21234 Increased surface albedo in the northern hemisphere. G. J. Kukla (Lamont-Doherty Geological Observatory, Palisades, N.Y.) and H. J. Kukla. *Science*, vol. 183, Feb. 22, 1974, p. 709-714. 24 refs. NSF Grant No. GX-28671K.

It was found that snow and pack-ice cover in the northern hemisphere formed earlier in the year and covered a larger area in the past 3 years than it did 7 years ago, when systematic satellite mapping began. This shift has probably produced a significant change in the hemispheric heat balance. Snow-covered grasslands or pack ice reflect approximately 80 per cent of insolation, while vegetated ground reflects only about 15 to 20 per cent and calm ocean reflects 5 to 10 per cent. G.R.

A74-21486 * Mapping Delaware's coastal vegetation and land use from aircraft and satellites. V. Klemas, D. Bartlett, and F. Daiber (Delaware University, Newark, Del.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 926-937. 6 refs. NSF Grant No. GI-33369; Contracts No. NAS5-21837; No. N00014-69-A-0407.

It is pointed out that coastal wetlands of the type found along the entire East Coast of the U.S. are well suited to remote sensing techniques, particularly multispectral analysis. Use of high altitude RB-57 and U-2 color-infrared imagery in the mapping of vegetation in Delaware's saline marshes was highly successful. Details of the mapping approach are discussed together with the use of automated multispectral analysis and the correlation of ERTS imagery. G.R.

A74-21487 The estuarine environment: Location of mean high water - Its engineering, economic and ecological potential. A. O. Fornes (Delaware University, Newark, Del.) and R. J. Reimold (Georgia University, Sapelo Island, Ga.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 938-978. 53 refs.

An investigation was conducted regarding the most feasible means for determining the accurate location of mean high water. The methodologies considered include the location of mean high water by vegetative species, topographic mapping using photogrammetric equipment, and the quantitative interpretation of thermal imagery. Questions of site selection are discussed together with the selection of photography, the tide data, the ground truth, and details of topographic mapping. Relations between tide levels and plant zonation are explored. G.R.

A74-21489 * Radar geomorphology of coastal and wetland environments. A. J. Lewis (Louisiana State University, Baton Rouge, La.) and H. C. MacDonald (Arkansas University, Fayetteville, Ark.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2.

Falls Church, Va., American Society of Photogrammetry, 1973, p. 992-1003. 21 refs. Research supported by the Louisiana State University; Grant No. DAAK02-68-C-0089; Contract No. NAS9-10261. Project THEMIS.

Details regarding the collection of radar imagery over the past ten years are considered together with the geomorphic, geologic, and

hydrologic data which have been extracted from radar imagery. Recent investigations were conducted of the Louisiana swamp marsh and the Oregon coast. It was found that radar imagery is a useful tool to the scientist involved in wetland research. G.R.

A74-21490 Photographic imagery and spectral properties of salt marsh vegetation as indicators of canopy characteristics. W. J. Pfeiffer, R. A. Linthurst, and J. L. Gallagher (Georgia University, Sapelo Island, Ga.). In: American Society of Photogrammetry, Fall through two meters of water and made it possible to integrate chlorophyll a concentrations over a 16 sq km area to demonstrate this remote sensing technique for biodegradable pollution monitoring. (Author)

A74-21493 * Recent progress in the hydrographic applications of a N2/Ne laser. G. D. Hickman (Sparcom, Inc., Alexandria, Va.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photogrammetry, 1973, p. 1041-1054. Research sponsored by the U.S. Geological Survey, U.S. Navy, NOAA, NASA and ARPA.

Laboratory and field measurements have been performed on the transmission/scattering characteristics of a pulsed neon laser as a function of water turbidity. These results have been used to establish the criteria for an airborne laser bathymetry system. Extensive measurements have been made of laser induced fluorescence using a pulsed tunable dye laser. Feasibility has been demonstrated for remote detection and possible identification of various types of algae and oils. Similar measurements made on a wide variety of organic dyes have shown this technique to have applications in remote measurement of subsurface currents, temperature, and salinity. T.M.

A74-25405 * Remote measurement of salinity in an estuarine environment. G. C. Thomann (NASA, Johnson Space Center, Earth Resources Laboratory, Bay St. Louis, Miss.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2.

Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 327-344. 21 refs.

The surface salinity of the estuary waters of the Mississippi delta and Mississippi sound was measured using an L-band radiometer at 21 cm wavelength mounted in a P3A Earth Resources Aircraft. The method used for correcting the effects of the atmosphere, cosmic noise, sea surface roughness, and constant radiometer errors is described. The dielectric constant of sea water was taken to be that of NaCl. An accuracy of 3 to 5 parts salt per thousand parts water was obtained for a 5 to 35 part salt per thousand parts water range. Theoretical accuracy is computed to be one part salt per thousand parts water. P.T.H.

A74-25415 The application of radar and infrared imagery to quantitative geomorphic investigations. P. J. Cannon (Texas University, Austin, Tex.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 503-519. 5 refs.

A74-25442 Snow and ice in the north polar regions - Ablation measurements from satellite photography 1966-1972. H. Kaminski (Bochum, Sternwarte, Bochum; Duisburg, Universität, Duisburg; Essen, Universität, Essen, West Germany). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2.

Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 959-980. 24 refs.

The continuous view of the earth from weather satellites has opened new possibilities for observation of global parameters. Satellite photography provides continuous coverage of the polar regions, so that various phenomena associated with snow, ice, and sea-ice can be tracked on a daily basis. For the years 1966 to 1972 ablation measurements, based on satellite photography, have been made for selected locations on the west coast of Greenland. Short- and long-term measurements permit predictions of climatic trends. All measurements and interpretations of satellite data must be correlated with local observations made at ground truth stations in order to assure maximum reliability of interpretation results. F.R.L.

A74-25446 * Mapping northern Atlantic coastal marshlands, Maryland-Virginia, using ERTS-1 imagery. V. Carter (American University; U.S. Geological Survey, Washington, D.C.), J. McGinness, and R. R. Anderson (American University, Washington, D.C.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1011-1020. Contract No. NAS5-21752.

A74-25447 * Mapping southern Atlantic coastal marshlands, South Carolina-Georgia, using ERTS-1 imagery. R. R. Anderson, V. Carter, and J. McGinness (American University, Washington, D.C.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1021-1028. Contract No. NAS5-21752.

A74-25449 The use of ERTS-1 imagery in the regional interpretation of geology, vegetation, permafrost distribution and estuarine processes in Alaska. D. M. Anderson, H. L. McKim, L. W. Gatto, R. K. Haugen, and W. K. Crowder (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1049-1071. 13 refs.

A74-25454 Water temperature monitoring by thermal scanning. P. J. Ryan, K. D. Stolzenbach, and R. A. Elder (Tennessee Valley Authority Engineering Laboratory, Norris, Tenn.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1137-1145. 10 refs.

Airborne thermal infrared detection has become a popular water temperature survey technique because it has the potential to provide the required synoptic coverage. The factors affecting the qualitative and quantitative nature of such surveys are discussed. Emphasis is on the difficulties of determining subsurface temperature from surface measurements rather than on the effects of reflected sky radiation and atmospheric attenuation. It is considered that errors in the determination of water temperature may be reduced, but not eliminated by applying computed or observed corrections. F.R.L.

A74-25455 * Signature analysis of reflectance spectra of phytoplankton and sediment in inland waters. G. W. Grew (NASA, Langley Research Center, Hampton, Va.). In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1147-1172. 6 refs.

A74-25456 * The use of near infrared photography for aerial observation of phytoplankton blooms. W. E. Bressette (NASA, Langley Research Center, Space Applications and Technology Div., Hampton, Va.). In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1173-1186. 7 refs.

A74-25460 Land cover delineation methods and presentation alternatives applicable to the Tennessee River watershed. A. R. Stevens (Tennessee Valley Authority, Chattanooga, Tenn.). In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1269-1285. 5 refs.

A74-25461 Developments in applications of remote sensing to hydrology through continuous simulation. R. Ambaruch and J. W. Simmons (IBM Electronic Systems Center, Huntsville, Ala.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1287-1306. 5 refs.

Description of the concept, progress, and initial results of a study aimed at forecasting stream flows with the aid of simulation models whose operational parameters are determined from remote observation. The area chosen for study is the Tennessee Valley for which abundant climatological streamflow and physiographic data have been accumulated. Attention is given to the progress achieved to date in the selection of the calibration and simulation models, construction of the data base, analysis of the sensitivity of the simulation model to variation in its parameters, and methods used to derive model parameter values from aerial photographs. Demonstration of the feasibility of this concept will lead to a means of predicting the hydrological behavior of ungaged watersheds without extensive instrumentation or the need to wait several years for accumulation of historical data. T.M.

A74-26178 * Inventory of Delaware's wetlands. V. Klemas, F. C. Daiber, D. Bartlett, O. W. Crichton, and A. O. Fornes (Delaware University, Newark, Del.). *Photogrammetric Engineering*, vol. 40, Apr. 1974, p. 433-439. 7 refs. NSF Grant No. GI-33369; Contracts No. NAS5-21837; No. N00014-69-A-0407.

A mapping technique utilizing the General Electric Multispectral Data Processing System to analyze NASA RB-57 color-infrared imagery and applied in the mapping of Delaware's wetlands is described. It is shown to represent a high-speed, cost-effective method for producing enhanced photomaps showing a number of spectral classes. M.V.E.

A74-26876 Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Symposium sponsored by the American Water Resources Association. Edited by K. P. B. Thomson, R. K. Lane (Canada Centre for Inland Waters, Burlington, Ontario, Canada), and S. C. Csallany. Urbana, Ill., American Water Resources Association (AWRA Proceedings, No. 17), 1973. 446 p. \$15.

Questions concerning water resources management in Canada are considered together with evaluation of environmental quality, the mapping of the 1973 Mississippi river floods from the earth resources technology satellite, recent applications of remote sensing to water resources in Hawaii, and the use of ERTS-1 imagery in the national program for the inspection of dams. Other topics discussed include the analysis of the drainage pattern of selected areas of Canada using

ERTS-1 imagery as a base, a four wavelength light detection and ranging system applied to the determination of chlorophyll A concentration and algae color group, and the use of remote sensing for the mapping of aquatic vegetation in the Keweenaw lakes. Digital processing techniques in thermal plume analysis are examined along with the remote sensing of stream flow rates.

G.R.

A74-26877 * Remote sensing and water resources - U.S. Space Program. M. W. Molloy (NASA, Washington, D.C.) and V. V. Salomonson (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 6-38. 32 refs.

Since the launch of TIROS I in 1960, the utility of remote sensing from orbit for monitoring the earth's weather has been conclusively demonstrated. The past decade has also seen progress in applying remote sensing to the observation of terrestrial features. Variations in snow and ice cover, surface water, river and lake turbidity, and other hydrological features are now being accurately observed from orbital altitudes by the Earth Resources Technology Satellite (ERTS-1), NOAA-2, and Nimbus 5. Satellite visible, infrared and microwave measurements will be continued over the next few years, with improved spatial and spectral accuracy, by Skylab, ERTS-B, and Nimbus F. Delineations of soil and snow moisture variations, thermal patterns in lakes and estuaries, and regions of heavy precipitation are among the results anticipated. (Author)

A74-26878 Mapping of the 1973 Mississippi River floods from the Earth Resources Technology Satellite /ERTS/. M. Deutsch, F. H. Ruggles (U.S. Geological Survey, Washington, D.C.), P. Guss (Lockwood, Kessler, and Bartlett, Inc.), and E. Yost (Long Island University, Brookville, N.Y.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 39-55. 7 refs.

On March 31, and May 4 and 5, 1973, the first Earth Resources Technology Satellite (ERTS-1) obtained multispectral scanner imagery over the Mississippi River below St. Louis, Missouri. The river was in flood, and the ERTS data provided the first opportunity for regional synoptic mapping of the extent of flooding at the time the imagery was obtained along a 1200 river-mile reach and some of its tributaries. The flood data were compared with imagery collected by ERTS on October 1 and 2, 1972, when the rivers were confined to their normal channels. The specially processed data were analyzed by additive-color techniques, and special enhancements were prepared to aid in interpretation of the data. The extent of flooding was delineated by additive-color, temporal composites of MSS band 7 infrared images. The temporal composites vividly depict, on a single scene, the flooded areas in relation to the normal channel.

(Author)

A74-26879 * Mississippi Sound remote sensing study. B. H. Atwell and G. C. Thomann (NASA, Mississippi Test Facility, Earth Resources Laboratory, Bay St. Louis, Miss.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 57-88. 29 refs.

A study of the Mississippi Sound was initiated in early 1971 by personnel of NASA Earth Resources Laboratory. Four separate seasonal experiments consisting of quasi-synoptic remote and surface measurements over the entire area were planned. Approximately 80 stations distributed throughout Mississippi Sound were occupied. Surface water temperature and secchi extinction depth were measured at each station and water samples were collected for water

quality analyses. The surface distribution of three water parameters of interest from a remote sensing standpoint - temperature, salinity and chlorophyll content - are displayed in map form. Areal variations in these parameters are related to tides and winds. A brief discussion of the general problem of radiative measurements of water temperature is followed by a comparison of remotely measured temperatures (PRT-5) to surface vessel measurements. (Author)

A74-26880 Some recent applications of remote sensing to water resources in Hawaii. Y.-S. Fok and W. M. Adams (Hawaii, University, Honolulu, Hawaii). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 89-103. 20 refs.

This paper summarizes some recent applications of remote-sensing methods to survey the locations of offshore spring water for further evaluation of water resources along coastlines. Multispectral photography was used to study the color difference between sea water and offshore spring water. Infrared thermometry showed that heat sensing could provide a one-dimensional heat-sensing record for a rapid reconnaissance of the coastal springs on Oahu. An infrared scanner covering 2000- to 5400-nanometer wavelength region could provide two-dimensional images in real time and could be recorded on films. (Author)

A74-26881 Water quality monitoring of reservoirs on the Colorado River utilizing ERTS-1 imagery. L. K. Lepley, K. E. Foster, and L. G. Everett (Arizona, University, Tucson, Ariz.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 105-111.

Reflected radiation in the visible and invisible near infrared was recorded by ERTS-1 imagery, and the 70-mm negative transparencies were enlarged and processed for contrast enhancement in chemical, biological and hydrodynamic studies of Lake Mead waters. Possible causes of the detectable difference between the satellite images of Virgin Basin and Boulder Basin are discussed. V.Z.

A74-26882 ERTS-1 reservoir monitoring studies in Kansas. J. R. McCauley, H. L. Yarger, G. W. James, L. M. Magnuson, and G. R. Marzolf (University of Kansas Center for Research, Inc.; Kansas, University, Lawrence; Kansas State University of Agriculture and Applied Science, Manhattan, Kan.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 112-119.

This is a report on the progress achieved in the study of the major reservoirs in Kansas to determine the feasibility of monitoring fresh water resources by satellite. Two reservoirs, Tuttle Creek and Perry, have been the object of more intensive study to determine the properties of reservoirs which control the spectral intensity of reflected sunlight as detected by the ERTS-1 sensors. Water samples have been collected from these two lakes concurrent with satellite overpass and have been analyzed to determine the amount of suspended solids, chlorophyll content, and concentrations of phosphate, nitrate, and potassium ions. In addition, water temperature and turbidity at each sample site are measured. ERTS images in four spectral bands (green, red, red-infrared, and infrared) are regularly received for each satellite overpass of Kansas reservoirs. Attempts are then made to correlate the spectral signature of the reservoir with the various water properties that existed at the time of overflight. (Author)

A74-26883 The use of ERTS-1 imagery in the national program for the inspection of dams. H. L. McKim, T. L. Marlar, and D. M. Anderson (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 120-137. Army-supported research.

Earth Resources Technology Satellite (ERTS)-1 imagery has been evaluated and found to be useful in locating circular water bodies over 152 m in diameter. Dams on streams can be identified by an abrupt change in stream width. A linear termination on a water body is a reliable indication of a dam, particularly when it is inconsistent with the normal drainage pattern. Care must be exercised to avoid confusing cloud shadows with water bodies. However, the association of a cloud with its shadow usually can be accomplished since the sun angle is noted in the data given on each ERTS image. (Author)

A74-26885 * Lake Superior water quality near Duluth from analysis of aerial photos and ERTS imagery. J. P. Scherz and J. F. Van Domelen (Wisconsin, University, Madison, Wis.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 147-160. Grant No. NGL-50-002-127.

ERTS imagery of Lake Superior in the late summer of 1972 shows dirty water near the city of Duluth. Water samples and simultaneous photographs were taken on three separate days following a heavy storm which caused muddy runoff water. The water samples were analyzed for turbidity, color, and solids. Reflectance and transmittance characteristics of the water samples were determined with a spectrophotometer apparatus. This same apparatus attached to a microdensitometer was used to analyze the photographs for the approximate colors or wavelengths of reflected energy that caused the exposure. Although other parameters do correlate for any one particular day, it is only the water quality parameter of turbidity that correlates with the aerial imagery on all days, as the character of the dirty water changes due to settling and mixing. (Author)

A74-26886 * Preliminary utilization of Iran's ERTS-1 data in the field of geology and water resources. M. S. Akhavi (Plan and Budget Organization, Teheran, Iran) and K. Ebtehadj (Plan and Budget Organization, Teheran, Iran; NASA, Washington, D.C.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 161-169. 7 refs. Research supported by the Plan and Budget Organization of Iran.

Preliminary analysis of a number of selected ERTS-1 images undertaken in the fields of geology and water resources for the purpose of testing its applicability and usefulness for mapping the natural resources of Iran identified a number of geologic and hydrologic phenomena, such as previously unknown faults, streams, and lakes. Due to a number of limiting factors, the results of this study are by no means conclusive; yet, the encouraging results obtained demonstrate the importance of satellite imagery for multidisciplinary resource analysis purposes in Iran. (Author)

A74-26887 * New sensor on NOAA-2 satellite monitors the 1972-73 Great Lakes ice season. A. E. Strong (NOAA, National Environmental Satellite Service, Hillcrest Heights, Md.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 171-178. NASA-sponsored research.

The NOAA-2 satellite was launched Oct. 15, 1972 in a 790 nautical mile-high near-polar sun-synchronous orbit. The Very High Resolution Radiometer (VHRR) views earth in both the visible and thermal-IR regions of the electromagnetic spectrum at 1-kilometer resolution. Its orbit permits the satellite to acquire imagery on a daily basis over any given location at approximately 0900 and 2100 local time. Visible data at 1-kilometer resolution represents a 16-fold increase in data density over previous NOAA satellite capabilities. Thermal data are now available over an area at 100 times the previous NOAA-1 thermal data density. Following the onset of ice formation in Lake Erie early in January, ice buildup and thaw were observed as cloud cover permitted throughout the short winter season. (Author)

A74-26888 Hydrologic applications of the NOAA-2 Very High Resolution Radiometer. D. R. Wiesnet and D. F. McGinnis (NOAA, National Environmental Satellite Service, Washington, D.C.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 179-190. 5 refs.

A new environmental satellite, called NOAA-2, was launched Oct. 15, 1972. A new instrument, the Very High Resolution Radiometer (VHRR) is providing simultaneous visible and thermal images of the earth twice daily. The ground resolution of the VHRR is one kilometer, approximately four times better than that of visible band images on the previous generation of NOAA satellites, and 10 times better than the IR band images on previous satellites. Snow cover in mountainous terrain and in the midwestern plains regions is mappable in considerable detail. Imagery of this type should permit accurate mapping of the per cent of snow cover in large river basins. Ice build-up and extent in the coastal areas of Alaska have been determined from the IR imagery during the Arctic winter when conventional photography is not possible. Ice formation in the Great Lakes can also be monitored during cloudfree periods. (Author)

A74-26889 * Repetitive ERTS-1 observations of surface water variability along rivers and low-lying areas. A. Rango and V. V. Salomonson (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 191-199.

The Earth Resources Technology Satellite, ERTS-1, provides an 18 day repetitive coverage capability and observations in the 0.8-1.1 micron spectral region where the contrast between water and adjacent surfaces is relatively large. Using these capabilities, observations in Virginia, Iowa, Missouri, and California have been acquired showing distinct patterns of flooding. Repetitive views of these areas before and after flooding have been examined, and flood mapping was performed. Sloughs in California can be seen to expand in terms of the area covered by standing water as time extends from summer to autumn. The results indicate that ERTS-1 imagery can be a valuable adjunct to conventional and aircraft survey methods for ascertaining the amount of area covered by water or affected by flooding. (Author)

A74-26890 ERTS-1 imagery for water inventory, Southern High Plains, Texas and New Mexico. C. C. Reeves, Jr. (Texas Tech University, Lubbock, Tex.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 201-208.

Optical and computer analysis of ERTS-1 multispectral scanner (MSS) imagery over the Southern High Plains, Texas, and New Mexico shows that individual storm paths and intermittent lake

basins can be monitored, ground-truth allowing computation of the amount of water in surface storage and thus available for local use. Water depths can be differentiated by density slicing. Select problems with ERTS-1 satellite imagery concern resolution and spectral sensitivity. Definition in semi-arid to arid areas is poor in the green range and best in the red range. However, irrigated agriculture as well as lake water will image opaque in the red range, thus the near-infrared is best for a wet lake census. (Author)

A74-26891 **Analysis of the drainage pattern of selected areas of Canada using ERTS-1 imagery as a base.** A. B. Kesik (Waterloo, University, Waterloo, Ontario, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 209-224. 21 refs.

A random collection of 20 ERTS-1 images processed by the Canadian Centre for Remote Sensing (CCRS) has been tested for presentation of the drainage pattern. The technique of manual tracing of the drainage network as well as measurements of the drainage densities have been used as the simplest methods applied by the interpreters. Seven examples from different parts of Canada illustrate the results of investigations. (Author)

A74-26897 * **Applications of thermal remote sensing to detailed ground water studies.** J. Souto-Maior (British Columbia, University, Vancouver, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 284-298. 10 refs. Grant No. NGL-50-002-021.

Three possible applications of thermal (8-14 microns) remote sensing to detailed hydrogeologic studies are discussed in this paper: (1) the direct detection of seeps and springs, (2) the indirect evaluation of shallow ground water flow through its thermal effects on the land surface, and (3) the indirect location of small volumes of ground water inflow into surface water bodies. An investigation carried out with this purpose in an area containing a complex shallow ground water flow system indicates that the interpretation of the thermal imageries is complicated by many factors, among which the most important are: (1) altitude, angle of view, and thermal-spatial resolution of the sensor; (2) vegetation type, density, and vigor; (3) topography; (4) climatological and micrometeorological effects; (5) variation in soil type and soil moisture; (6) variation in volume and temperature of ground water inflow; (7) the hydraulic characteristics of the receiving water body, and (8) the presence of decaying organic material. (Author)

A74-26899 **Utilization of aerial photographs for measuring land use changes in watersheds.** D. B. Stafford, J. T. Ligon, and M. E. Nettles (Clemson University, Clemson, S.C.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 312-324. Research supported by the U.S. Department of the Interior.

The paper describes techniques for using existing aerial photographs to investigate land use changes in watersheds. Land use changes in two watersheds in western South Carolina, U.S.A., were examined. One of the watersheds has experienced rapid urbanization in recent years and the other watershed has experienced significant changes in agricultural land use over the past 26 years. Existing aerial photographs taken at approximately five-year intervals were used to delineate, classify, code, and measure the areas of various land use classes in the two watersheds. The land use classes employed were those that had experienced significant changes and which had different runoff characteristics. The results obtained from the

research program indicate that the use of existing aerial photographs to obtain data on the historical distribution of land use in watersheds represents a very satisfactory approach that could be employed more widely. (Author)

A74-26901 **Use of remote sensing for mapping of aquatic vegetation in the Kawartha Lakes.** I. Wile (Ministry of the Environment, Rexdale, Ontario, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 331-336.

Many of the Kawartha Lakes are naturally productive owing to the fertile soils drained or flooded by the creation of the Trent Canal System. However, increased enrichment resulting from agricultural runoff, urbanization and inadequate containment of cottage wastes, has accelerated the production of aquatic plants. Mechanical harvesting appears to show definite promise since it is target specific and removes problem biomass from the system while leaving the lower portions of the plants and associated invertebrate organisms intact. To develop suitable cutting patterns, accurate mapping of the weed beds is essential. During the summer of 1972, color and infrared films were used at altitudes ranging from 600 to 3,000 m. For the photographic coverage of the entire system, an altitude of 1,500 m was selected using an 85 mm focal length Zeiss camera and color film. Supplementary coverage of shallow areas with infrared film was used primarily to aid in distinguishing emergent shoreline vegetation. The results and significance of the imagery to this study are discussed. (Author)

A74-26903 **The utilization of sun-glint in a study of lake dynamics.** R. P. Bukata and W. D. McColl (Canada Centre for Inland Waters, Burlington, Ontario, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 351-367.

A series of low-, medium-, and high-altitude overflights provided visible and infrared data of Lake Ontario and its surrounding basin in June 1972. A study of the areas illuminated by mirror-reflected solar illumination (sun glint) is described with regard to the physical properties of sun glint present in aerial photographs and the role of sun glint in evaluating the nature of the dynamical processes occurring within the lake and which, in general, display surficial features. A detailed investigation is presented of the role of sun glint in evaluating the dynamics defining the June 7, 1972, upwelling event off the north shore of Lake Ontario, an event for which considerable ancillary ground-truthing was available. By combining the aerial photography with the existing ground truth, it is concluded that both a spatial and a temporal change in the thermal time gradient are required to produce surface features that may be readily discernible in sun glint. (Author)

A74-26905 * **Remote sensing of *Myriophyllum spicatum* L. in a shallow, eutrophic lake.** T. D. Gustafson and M. S. Adams (Wisconsin, University, Madison, Wis.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 387-391. AEC-NSF-supported research; Grant No. NGL-50-002-127.

An aerial 35 mm system was used for the acquisition of vertical color and color infrared imagery of the submergent aquatic macrophytes of Lake Wingra, Wisconsin. A method of photographic interpretation of stem density classes is tested for its ability to make standing crop biomass estimates of *Myriophyllum spicatum*. The results of film image density analysis are significantly correlated with stem densities and standing crop biomass of *Myriophyllum* and with the biomass of *Oedogonium* mats. Photographic methods are contrasted with conventional harvest procedures for efficiency and accuracy. (Author)

A74-26906 Multispectral sensing of water parameters. F. C. Polcyn and D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 394-403, 9 refs.

With the development of the multispectral scanner, improved techniques for mapping temperature gradients, turbidity, water color, and alga concentrations over large areas have been demonstrated. Where lake water transparency is sufficiently clear to detect light reflections from the lake floor, a remote calculation of water depth is possible. Depths to 20 ft have been measured in the nearshore zone of Lake Michigan and near the Little Bahama Bank. Maps showing relative chlorophyll concentrations have been made for a portion of the shoreline areas near Port Sheldon, Michigan. Examples of the mapping of the thermal bar in Lake Michigan, river discharges, and the nearshore environment are shown. Spectral characteristics related to chlorophyll concentrations were investigated for test samples across the thermal bar taken during the spring formation of the bar. (Author)

A74-26907 * Remote sensing of stream flow rates - Correlation of meander and discharge spectra. R. E. Lingenfelter and G. Schubert (California, University, Los Angeles, Calif.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973.

Urbana, Ill., American Water Resources Association, 1973, p. 404-418, 15 refs. Grant No. NGL-05-003-404.

Results of a study of river meander patterns and discharges, in which attempt was made to correlate the discharge spectrum of a river with the river meander power spectrum determined from aerial and satellite imagery. Some significant characteristics of both the discharge and the meander spectra have been discovered. Discharge frequency spectra based on long-term records of daily streamflow are found to have an inverse power-law dependence on discharge. This is shown to reflect the short-term decay of individual floods which are found to have an inverse power-law dependence on time. Meander power spectra for a number of river reaches, digitized from aerial photography, also show significant structure, the power spectral density having an inverse power-law dependence on wave number over one or more portions of the spectrum with breaks in the spectra at characteristic wave numbers. A number of examples of typical discharge and meander spectra are shown. (Author)

N74-16022* Army Construction Engineering Research Lab., Champaign, Ill.

EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Progress Report, 9 Dec. 1973 - 8 Feb. 1974

Ravinder K. Jain, Principal Investigator 8 Feb. 1974 2 p ERTS

(NASA Order S-70255-AG)

(E74-10261; NASA-CR-136614) Avail: NTIS HC \$3.00 CSCL 08H

N74-16036* Michigan State Univ., East Lansing.
UPPER KALAMAZOO WATERSHED LAND COVER INVENTORY

Benjamin Richason, III and William Enslin Oct. 1973 42 p (Grant NGL-23-004-083)

(NASA-CR-136621) Avail: NTIS HC \$4.25 CSCL 08H

Approximately 1000 square miles of the eastern portion of the watershed were inventoried based on remote sensing imagery. The classification scheme, imagery and interpretation procedures, and a cost analysis are discussed. The distributions of land cover within the area are tabulated. F.O.S.

N74-16037* Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 10, 1973

10 Jan. 1974 160 p refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 10, 1973 p 3-62, 73-81, 87-103, 110-122

(JPRS-60954) Avail: NTIS HC \$10.00

Hydrological management aspects for conservation of water resources and water quality in the U.S.S.R. are considered

N74-16046 Joint Publications Research Service, Arlington, Va.
UTILIZATION OF SATELLITE INFORMATION FOR HYDROLOGIC PURPOSES

V. V. Kupriyanov and V. G. Prokacheva In its Meteorology and Hydrol., no. 10, 1973 (JPRS-60954) 10 Jan. 1974 p 106-115 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 10, 1973 p 87-93

The possibilities of using information coming from artificial satellites for hydrologic purposes are considered. Examples are presented of decoding the television pictures from artificial satellites to study the snow cover, the ice situation in lakes, and hydrographic features. Prospects for the development of methods of decoding the television images from artificial satellites for the solution of problems connected with evaluating water resources, water regime and quality are evaluated. Author

N74-16058* National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

PROCEDURES MANUAL FOR DETECTION AND LOCATION OF SURFACE WATER USING ERTS-1 MULTISPECTRAL SCANNER DATA. VOLUME 1: SUMMARY

Dec. 1973 56 p refs Revised

(NASA-TM-X-69779; JSC-08454-Vol-1-Rev-A) Avail: NTIS HC \$5.00 CSCL 08H

A computer-aided procedure, for use in the detection and location of areas of surface water, was developed. The procedure utilizes data acquired by the unmanned Earth Resources Technology Satellite (ERTS-1) in conjunction with ancillary data in the form of topographic and highway maps, and meteorological data summaries. The total computer-aided procedure is summarized, the resource requirements for implementation are presented, and operational use of the information derived from the procedure is discussed. Author

N74-16366* Army Electronics Command, Fort Monmouth, N.J.

THE HYDROMETEOROLOGIC GROUND TRUTH FACILITY AT WHITE SANDS MISSILE RANGE, NEW MEXICO

William J. Stone Oct. 1973 40 p refs

(DA Proj. 1TO-61102-B-53A)

(AD-769629; ECOM-5513) Avail: NTIS CSCL 04/2

In preparation for the launch of a geosynchronous meteorologic satellite, SMS/GOES-A, several ground truth facilities are being established at White Sands Missile Range, New Mexico. One of these facilities, consisting of two instrumented watersheds on the western piedmont slope of the San Andres Mountains, Dona Ana County, New Mexico, will provide basic hydrometeorologic data. Instruments used include: eight recording rain gages, nine nonrecording rain gages, five recording, flood stage stream gages, five self-siphoning sediment samplers, one recording water well monitor, and three evaporation stations. All equipment, except that for the evaporation stations, is provided, operated, and maintained under contract by the U.S. Geological Survey, Albuquerque. Data provided by these instruments will be used to study the hydrometeorologic controls of soil trafficability and to investigate the possibility of predicting trafficability from hydrometeorologic conditions. Author (GRA)

N74-17070* Wolf Research and Development Corp., Riverdale, Md.

THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Dec. 1973 - Jan. 1974

Allan J. Jelacic, Principal Investigator 10 Feb. 1974 6 p refs ERTS

(Contract NAS5-21761)

(E74-10276; NASA-CR-136662; PR-7) Avail: NTIS HC \$3.00 CSCL 08L

N74-17071*# Geological Survey, Reston, Va.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Jul. - 31 Dec. 1973
 Edward J. Pluhowski, Principal Investigator 1 Jan. 1974 7 p ERTS
 (NASA Order S-70243-AG-2)
 (E74-10278; NASA-CR-136664) Avail: NTIS HC \$3.00 CSCL 08H

The author has identified the following significant results. Two unusual turbidity features were detected in imagery obtained over Lake Ontario on September 19, 1973. The location of a submerged sewer outfall was detected in frame 1423-15224-5 about 2 kilometers offshore opposite a treatment plant serving Rochester, New York. The other feature was a thermal heat plume made visible by an erosive eastward moving longshore current. The thermal plume, which extended about 3 kilometers into the lake, results from the discharge of cooling water from a nuclear power plant located 20 miles east of Rochester, New York. Under an offshore wind field, the outer edge of the Niagara River plume extended 30 kilometers into Lake Ontario on September 3, 1973. By way of contrast, a strong west-northwest wind on April 29, 1973, confined the plume to about 3 kilometers of the lake's south shore. The size of the Genesee River plume is largely dependent on discharge. During the spring high flow season, the plume extended over 22 square kilometers of the lake's surface on May 16, 1973. As runoff dwindled with the approach of summer, the plume contracted to less than 1 square kilometer in area by mid-July.

N74-17073*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Jan. 1974
 Jack G. Quade, Principal Investigator Jan. 1974 3 p EREP
 (Contract NAS9-13274)
 (E74-10281; NASA-CR-136667) Avail: NTIS HC \$3.00 CSCL 08G

N74-17077*# Corps of Engineers, Waltham, Mass.
NEW ENGLAND RESERVOIR MANAGEMENT Progress Report, 3-23 Jan. 1974
 Saul Cooper and Duwayne Anderson, Principal Investigators (CRREL) 23 Jan. 1974 3 p EREP
 (NASA Order T-4646-B)
 (E74-10286; NASA-CR-136672) Avail: NTIS HC \$3.00 CSCL 08H

N74-17086*# Geological Survey, Reston, Va.
THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Nov. - 31 Dec. 1973
 Daniel B. Krinsley, Principal Investigator 15 Jan. 1974 2 p ERTS
 (NASA Order S-70243-AG-3)
 (E74-10297; NASA-CR-136340) Avail: NTIS HC \$3.00 CSCL 08H

The author has identified the following significant results. False-color composites made from ratioed and stretched transparencies, generated from CCT's of ERTS-1, have enhanced hydrologic and morphologic differences within the playa surficial sediments. A composite of ratios 4/6, 5/7, 15/61 and 4/7 using blue, red, yellow, and green, respectively, was useful in separating wet, water, and dry areas in the salt crust and for delineating smooth and rough salt where relief was less than 20 cm.

N74-17087*# Geological Survey, Reston, Va.
THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Sep. - 31 Oct. 1973
 Daniel B. Krinsley, Principal Investigator 31 Oct. 1973 2 p ERTS
 (NASA Order S-70243-AG-3)
 (E74-10298; NASA-CR-136692) Avail: NTIS HC \$3.00 CSCL 08H

The author has identified the following significant results. Hydrologic inventories, throughout the year, were made in interior basins that have not been measured previously because of their inaccessibility. Interior basins during the last ERTS-1 year (August 1972 to August 1973) had driest ground conditions in late September 1972 and had wettest ground conditions from March through May 1973, depending upon location. Bearing strengths of playa soils can be inferred from the changing hydrologic conditions through the seasons as recorded by ERTS-1, with prior ground control. Slight differences in salt-crust morphology and in moisture content of playa soils can be greatly enhanced by rationing and stretching techniques. Differences in water area and silt content can be enhanced by using a three-stage photographic masking technique employing bands 4, 5, and 7.

N74-17089*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
[OBTAIN DATA OVER FOUR BASIC TEST AREAS WITHIN THE WABASH VALLEY RIVER BASIN WITH EMPHASIS ON CROP IDENTIFICATION, ACREAGE MEASUREMENT AND URBAN STUDIES] Monthly Report, May 1973
 LeRoy F. Silva, Principal Investigator May 1973 2 p EREP
 (Contract NAS9-13301)
 (E74-10300; NASA-CR-136770) Avail: NTIS HC \$3.00 CSCL 08F

N74-17092*# Wolf Research and Development Corp., Riverdale, Md.
THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Jun. - Jul. 1973
 A. J. Jelacic, Principal Investigator 10 Aug. 1973 10 p ERTS
 (Contract NAS5-21761)
 (E74-10303; NASA-CR-136785; PR-5) Avail: NTIS HC \$4.00 CSCL 08L

N74-17105*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A STUDY OF THE UTILIZATION OF ERTS-1 DATA FROM THE WABASH RIVER BASIN Progress Report, 1 Jul. - 31 Dec. 1973
 David A. Landgrebe, Principal Investigator et al Jan. 1974 52 p ERTS
 (Contract NAS5-21773)
 (E74-10321; NASA-CR-136812) Avail: NTIS HC \$5.75 CSCL 08H

The author has identified the following significant results. The most significant results were obtained in the water resources research, urban land use mapping, and soil association mapping projects. ERTS-1 data was used to classify water bodies to determine acreages and high agreement was obtained with USGS figures. Quantitative evaluation was achieved of urban land use classifications from ERTS-1 data and an overall test accuracy of 90.3% was observed. ERTS-1 data classifications of soil test sites were compared with soil association maps scaled to match the computer produced map and good agreement was observed. In some cases the ERTS-1 results proved to be more accurate than the soil association map.

N74-18018* Kansas Univ. Center for Research, Inc., Lawrence. Geological Survey.

KANSAS ENVIRONMENTAL AND RESOURCE STUDY: A GREAT PLAINS MODEL. MONITORING FRESH WATER RESOURCES. Semiannual Progress Report, Aug. 1973 - Jan. 1974

Harold L. Yarger, Principal Investigator and James R. McCauley
Feb. 1974 19 p ERTS
(Contract NAS5-21822)
(E74-10342; NASA-CR-136854; SAPR-3) Avail: NTIS
HC \$4.00 CSCL 08H

The author has identified the following significant results
Processing and analysis of CCT's for numerous ground truth supported passes over Kansas reservoirs has demonstrated that sun angle and atmospheric conditions are strong influences on water reflectance levels as detected by ERTS-1 and can suppress the contributions of true water quality factors. Band ratios, on the other hand, exhibit very little dependence on sun angle and sky conditions and thus are more directly related to water quality. Band ratio levels can be used to reliably determine suspended load. Other water quality indicators appear to have little or no affect on reflectance levels.

N74-18027* California Univ., Davis.

WATER SUPPLY STUDIES

Robert H. Burgy, Vidal R. Algazi, William C. Draeger, C. W. Churchman, Randall W. Thomas, Donald T. Lauer, Ida Hoos, Paul F. Krumpe, James D. Nichols, and Michael J. Gialdini. *In its An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech.* 31 Dec. 1973 110 p refs

CSCL 08H

The primary test site for water supply investigations continues to be the Feather River watershed in northeastern California. This test site includes all of the area draining into and including the Oroville Reservoir. The principal effort is to determine the extent to which remote sensing techniques, when properly employed, can provide information useful to those persons concerned with the management and planning of lands and facilities for the production of water, using the Oroville Reservoir and the California Water Project as the focus for the study. In particular, emphasis is being placed on determining the cost effectiveness of information derived through remote sensing as compared with that currently being derived through more conventional means.

A.L.

N74-18028* California Univ., Riverside.

WATER DEMAND STUDIES

L. W. Bowden, J. E. Estes, C. W. Churchman, C. W. Johnson, J. R. Huning, K. Rozelle, J. Hamilton, G. Washburn, L. R. Tinney, and R. R. Thaman. *In its An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech.* 31 Dec. 1973 71 p refs

CSCL 08H

The areas of focus of the Santa Barbara and Riverside groups in conducting water demand studies are the central and southern California regional test sites, respectively. Within each test site, sub-areas have been selected for use in the making of detailed investigations. Within each of these sub-areas an in-depth evaluation is being made as to the capability of remote sensing systems to provide pertinent data relative to water demand phenomena. These more limited sub-areas are: (1) Kern County and the San Joaquin Basin; (2) Chino-Riverside Basin; and (3) the Imperial Valley. Rational for the selection of these subareas included the following: Much of the previous remote sensing research had been conducted in these areas and therefore a great deal of remote sensing imagery and pertinent ground truth for the areas was already available.

A.L.

N74-18029* California Univ., Berkeley.

WATER IMPACT STUDIES

Robert N. Colwell. *In its An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech.* 31 Dec. 1973 3 p
CSCL 08H

An investigation has begun into the potential impact of using modern remote sensing techniques as an aid in managing, even on a day-to-day basis, the storage, flow, and delivery of water made available through the California Water Project. It is obvious that the amount of this impact depends upon the extent to which remote sensing is proven to be useful in improving predictions of both the amount of water that will be available and the amount that will be needed. It is also proposed to investigate the potential impact of remote sensing techniques as an aid in monitoring, and perhaps even in directing, changes in land use and life style being brought about through the increased availability of water in central and southern California as a result of the California Water Project. The impact of remote sensing can be of appreciable significance only if: (1) the induced changes are very substantial ones; (2) remote sensing is found, in this context, to be very useful and potentially very cost effective; and (3) resource managers adopt this new technology. Analyses will be conducted of the changing economic bases and the new land use demands resulting from increased water availability in central and southern California.

A.L.

N74-18037* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ADVANCES IN WATER RESOURCES MONITORING FROM SPACE

Vincent V. Salomonson. Feb. 1974 23 p refs
(NASA-TM-X-70600; X-913-74-44) Avail: NTIS HC \$4.25
CSCL 08H

Nimbus-5 observations indicate that over the oceans the total precipitable water in a column of atmosphere can be estimated to within + or - 10%, the liquid water content of clouds can be estimated to within + or - 25%, areas of precipitation can be delineated, and broad estimates of the precipitation rate obtained. ERTS-1 observations permit the measurement of snow covered area to within a few percent of drainage basin area and snowline altitudes can be estimated to within 60 meters. Surface water areas as small as 1 hectare can be inventoried over large regions such as playa lakes region of West Texas and Eastern New Mexico. In addition, changes in land use on water-sheds occurring as a result of forest fires, urban development, clear cutting, or strip mining can be rapidly obtained.

Author

N74-18047* Smithsonian Institution, Washington, D.C. Chesapeake Bay Center for Environmental Studies.

COLLECTION AND ANALYSIS OF REMOTELY SENSED DATA FROM THE RHODE RIVER ESTUARY WATERSHED. Annual Report, 10 Oct. 1971 - 10 Oct. 1972

Dale W. Jenkins and Francis S. L. Williamson. Oct. 1973 74 p refs
(Contract NAS6-1913)

(NASA-CR-62094) Avail: NTIS HC \$6.75 CSCL 08H

The remote sensing study to survey the Rhode River watershed for spray irrigation with secondarily treated sewage is reported. The standardization of Autumn coloration changes with Munsell color chips is described along with the mapping of old field vegetation for the spray irrigation project. The interpretation and verification of salt marsh vegetation by remote sensing of the water shed is discussed.

F.O.S.

N74-18252# Joint Publications Research Service, Arlington, Va.

METEOROLOGY AND HYDROLOGY, NO. 11, 1973

15 Feb. 1974 205 p refs. Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 11, 1973 p 1-126
(JPRS-61249) Avail: NTIS HC \$13.25

Articles on microclimate, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, and related activities are presented. The articles are based on projects conducted in the Soviet Hydrometeorological Service.

N74-18966* Environmental Research Inst. of Michigan, Ann Arbor.

A SKYLAB PROGRAM FOR THE INTERNATIONAL HYDROL-

OGICAL DECADE (IHD) Quarterly Report, Jun. - Aug. 1973

Fabian C. Polcyn and Thomas W. Wagner, Principal Investigators
6 Mar. 1974 3 p EREP
(Contract NAS9-13275)
(E74-10357; NASA-CR-137042; ERIM-102300-6-L; QR-2)
Avail: NTIS HC \$4.00 CSCL 08H

N74-18967*# Environmental Research Inst. of Michigan, Ann Arbor.**A SKYLAB PROGRAM FOR THE INTERNATIONAL HYDROLOGICAL DECADE (IHD) Quarterly Report, Sep. - Nov. 1973**

Fabian C. Polcyn and Thomas W. Wagner, Principal Investigators
6 Mar. 1974 5 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13275)
(E74-10358; NASA-CR-137043; ERIM-102300-7-L; QR-3)
Avail: NTIS HC \$4.00 CSCL 08H

N74-18983*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.**ERTS-1: AUTOMATED LAND-USE MAPPING IN LAKE WATERSHEDS Special Report**

Phillip E. Chase, Principal Investigator, Robert H. Rogers, Larry E. Reed, and V. Elliot Smith (Cranbrook Inst. of Tech.) Mar. 1974 24 p refs ERTS
(Contract NAS5-21810)
(E74-10374; NASA-CR-137071) Avail: NTIS HC \$4.25 CSCL 08B

The author has identified the following significant results. ERTS-1 computer compatible tapes were used as a basis to generate land use maps in lake watersheds in southeastern Michigan. These maps, generated on a repetitive basis, provide information essential to governmental agencies concerned with planning and control of lake eutrophication. The ERTS mapping products included geometrically current land use map overlays at 1:250,000 and 1:48,000 scale and area measurement printouts. The printouts provide, within the watershed boundaries and by land use category, a quantitative measure of the amount of land, in square kilometers and acres. This quantitative measure of land use in watersheds is essential to the development and application of deterministic models, which compute nutrient flows into lakes and establish lake eutrophication rates.

N74-18984*# Prescott College, Ariz. THE HYDROLOGY OF PREHISTORIC FARMING SYSTEMS IN A CENTRAL ARIZONA ECOTONE Quarterly Report, 1 Jan. - 31 Mar. 1974

George J. Gumerman, Principal Investigator 25 Mar. 1974 5 p EREP
(Contract NAS9-13342)
(E74-10375; NASA-CR-137072) Avail: NTIS HC \$4.00 CSCL 08H

N74-18998*# Texas Univ., Austin. A HYDROGEOMORPHIC APPROACH TO EVALUATING FLOOD POTENTIAL IN CENTRAL TEXAS FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY

Victor R. Baker, Principal Investigator, Robert K. Holz, and Steven D. Hulke [1974] 2 p EREP
(Contract NAS9-13312)
(E74-10389; NASA-CR-137207) Avail: NTIS HC \$4.00 CSCL 08H

N74-19008*# Environmental Research and Technology, Inc., Lexington, Mass.**THE APPLICATION OF ERTS IMAGERY TO MAPPING SNOW COVER IN THE WESTERN UNITED STATES Final Report, 28 Jun. 1972 - 31 Dec. 1973**

James C. Barnes, Principal Investigator, Clinton J. Bowley, and David A. Simmes Jan. 1974 80 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21803)
(E74-10400; NASA-CR-137223; ERT-P-407-F) Avail: NTIS HC \$7.00 CSCL 08L

The author has identified the following significant results. In much of the western United States a large part of the utilized water comes from accumulated mountain snowpacks; thus, accurate measurements of snow distributions are required for input to streamflow prediction models. The application of ERTS-1 imagery for mapping snow has been evaluated for two geographic areas, the Salt-Verde watershed in central Arizona and the southern Sierra Nevada in California. Techniques have been developed to identify snow and to differentiate between snow and cloud. The snow extent for these two drainage areas has been mapped from the MSS-5 (0.6 - 0.7 microns) imagery and compared with aerial survey snow charts, aircraft photography, and ground-based snow measurements. The results indicate that ERTS imagery has substantial practical applications for snow mapping. Snow extent can be mapped from ERTS-1 imagery in more detail than is depicted on aerial survey snow charts. Moreover, in Arizona and southern California cloud obscuration does not appear to be a serious deterrent to the use of satellite data for snow survey. The costs involved in deriving snow maps from ERTS-1 imagery appear to be very reasonable in comparison with existing data collection methods.

N74-19020# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).**UTILIZATION OF SCANNER THERMAL INFRARED DATA IN STUDYING THE WATERSHED MANAGEMENT**

Mostafa K. Nasseir May 1973 41 p refs
(Proj. SERE)
(INPE-340-RI/116) Avail: NTIS HC \$5.25

The thermal infrared remote sensing techniques are applied to watershed management. Potential evapotranspiration was emphasized for methods depending on the surface temperature energy budget of the targets. Author

N74-19041*# Wisconsin Univ., Madison. Inst. for Environmental Studies.**REMOTE SENSING IN THE MIXING ZONE**

J. R. Villemonte, J. A. Hoopes, D. S. Wu, and T. M. Lillesand Aug. 1973 34 p refs Presented at AWRA Intern. Symp. on Remote Sensing of Water Resources, Burlington, Ontario, 11-14 Jun. 1973 Submitted for publication Sponsored in part by Dept. of Natural Resources
(Grant NGL-50-002-127)
(NASA-CR-137304; Rept-22) Avail: NTIS HC \$4.75 CSCL 08H

Characteristics of dispersion and diffusion as the mechanisms by which pollutants are transported in natural river courses were studied with the view of providing additional data for the establishment of water quality guidelines and effluent outfall design protocols. Work has been divided into four basic categories which are directed at the basic goal of developing relationships which will permit the estimation of the nature and extent of the mixing zone as a function of those variables which characterize the outfall structure, the effluent, and the river, as well as climatological conditions. The four basic categories of effort are: (1) the development of mathematical models; (2) laboratory studies of physical models; (3) field surveys involving ground and aerial sensing; and (4) correlation between aerial photographic imagery and mixing zone characteristics. Author

06 HYDROLOGY AND WATER MANAGEMENT

N74-19042* Wisconsin Univ., Madison. Inst. for Environmental Studies.

THE REMOTE SENSING OF AQUATIC MACROPHYTES PART 1: COLOR-INFRARED AERIAL PHOTOGRAPHY AS A TOOL FOR IDENTIFICATION AND MAPPING OF LITTORAL VEGETATION. PART 2: AERIAL PHOTOGRAPHY AS A QUANTITATIVE TOOL FOR THE INVESTIGATION OF AQUATIC ECOSYSTEMS

T. D. Gustafson and M. S. Adams Sep. 1973 28 p refs
Sponsored in part by AEC
(Grant NGL-50-002-127; Grant NSF AG-199)
(NASA-CR-137305; Rept-24) Avail: NTIS HC \$4.50 CSCL 08A

Research was initiated to use aerial photography as an investigative tool in studies that are part of an intensive aquatic ecosystem research effort at Lake Wingra, Madison, Wisconsin. It is anticipated that photographic techniques would supply information about the growth and distribution of littoral macrophytes with efficiency and accuracy greater than conventional methods. Author

N74-19939* Stanford Research Inst., Menlo Park, Calif.
STUDY OF TIME LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 6 Sep. 1973 - 6 Mar. 1974

Sidney M. Serebreny, Principal Investigator 16 Mar. 1974 17 p ERTS
(Contract NAS5-21841)
(E74-10403; NASA-CR-137237) Avail: NTIS HC \$4.00 CSCL 08H

N74-19942* Texas Technological Univ., Lubbock. Remote Sensing Lab.

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS Progress Report, Oct. 1973 - Mar. 1974

C. C. Reeves, Jr., Principal Investigator 31 Mar. 1974 7 p
(Contract NAS5-21720)
(E74-10406; NASA-CR-137252) Avail: NTIS ERTS CSCL 08H

N74-19956* Wolf Research and Development Corp., Riverdale, Md.

THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Feb. - Mar. 1974

Allan Jelacic, Principal Investigator 10 Apr. 1974 6 p refs
ERTS
(Contract NAS5-21761)
(E74-10422; NASA-CR-137281; PR-8) Avail: NTIS HC \$4.00 CSCL 08L

N74-19974* Ecosystems International, Inc., Millersville, Md.
THE PRACTICAL UTILIZATION OF REMOTE SENSING TECHNOLOGY FOR THE MANAGEMENT AND CONSERVATION OF NATURAL RESOURCES. PART 2: WATER RESOURCES MANAGEMENT

Peter A. Castruccio and Harry L. Loats, Jr. Mar. 1974 70 p refs
Avail: NTIS HC \$6.50 CSCL 08H

Satellite remote sensing data and its use as a tool in water resource management are examined. A working methodology for the utilization of remote sensing as well as illustrations of the technology are given. Other areas covered include flood plain identification, flood plain mapping, and construction of ungaged water shed models. E.H.W.

N74-19978* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HYDROLOGIC APPLICATIONS OF NIMBUS 5 ESMR DATA

T. J. Schmugge, A. Rango, L. J. Allison, and T. T. Wilheit Feb. 1974 27 p refs
(NASA-TM-X-70614; X-910-74-51) Avail: NTIS HC \$4.50 CSCL 08H

A region of low brightness temperature lying along the Mississippi River from Cairo, Illinois, to Morganza, Louisiana was observed in early Nimbus 5 Electrically Scanning Microwave Radiometer images. This region, which generally corresponds to an outwash aquifer in the Mississippi Valley, had brightness temperatures, at times as much as 40 K below the surrounding (drier) older uplands. Fluctuations of as much as 30 K were observed during the time interval 15 December 1972 to 28 February 1973. Comparison images taken from the Earth Resources Technology Satellite indicate that the study area is aligned with the Mississippi River floodplain, a region of potentially high soil moisture content. The brightness temperature fluctuations were compared with variations in precipitation and other hydrologic parameters in order to delineate the causative factors. Author

N74-20194* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE VIEWS OF HURRICANE CAMILLE

William E. Shenk and Edward B. Rodgers (Environmental Res. and Tech., Inc.) Washington Apr. 1974 82 p refs
(NASA-TN-D-7547; G-7405) Avail: NTIS HC \$4.00 CSCL 04B

Three periods within the life cycle of Hurricane Camille (1969) are studied with radiometric and camera measurements from Nimbus-3 and camera information from ATS-3 in conjunction with conventional information. These periods are the deepening phase, the interaction of Camille with midlatitude westerlies, and the excessive rain producing period when the cyclone was over the central Appalachian Mountain. Just prior to significant deepening, the Nimbus-3 Medium Resolution Infrared Radiometer (MRIR) showed that a pronounced feeder band had formed southeast of the center which was associated with the rapid transport of moisture into the storm circulation. During the rapid deepening phase the MRIR measurements indicated the development of large scale subsidence throughout the troposphere northwest of the center. When Camille was over the lower Mississippi Valley it acted as an obstruction to the environmental wind. A region of widespread subsidence was created west and north of the cyclone center. Increased cloud-top elevations, back to the levels reached when Camille was an intense cyclone over the Gulf of Mexico, were estimated from the Nimbus-3 High Resolution Infrared Radiometer (HRIR) measurements on August 20, 1969, when Camille produced rains of major flood proportions near the east slopes of the Appalachians in central Virginia. Author

N74-20949* National Aeronautics and Space Administration. Mississippi Test Facility, Bay Saint Louis.

[SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND COASTAL MARSHLANDS] Progress Report, 1 Jan. - 29 Feb. 1974

Robert H. Cartmill, Principal Investigator 11 Mar. 1974 2 p ERTS
(E74-10408; NASA-TM-X-70065) Avail: NTIS HC \$4.00 CSCL 08H

N74-20952* Calspan Corp., Buffalo, N.Y.

S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Quarterly Report, 1 Dec. 1973 - 28 Feb. 1974

Kenneth R. Piech, Principal Investigator 28 Feb. 1974 3 p EREP
(Contract NAS9-13336)

(E74-10424: NASA-CR-137350; QR-4) Avail: NTIS
 HC \$4.00 CSCL 08H

N74-21259# Joint Publications Research Service, Arlington, Va.

METEOROLOGY AND HYDROLOGY, NO. 12, 1973

1 Apr. 1974 189 p refs Transl. into ENGLISH of Meteorol. Gidrol. (Moscow), no. 12, 1973
 (JPRS-61632) HC \$12.50

Climatological, meteorological, and hydrological weather monitoring and forecasting methods are reported.

N74-21269 Joint Publications Research Service, Arlington, Va.
NEW VERSION OF THE METHOD OF AERIAL PHOTOGRAPHY OF SHADOWS TO STUDY THE SNOW COVER

Yu. D. Sharikov and V. G. Zdanovich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 p 90-95 refs
 Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 72-76

A simple method of determining the thickness of the snow cover in the mountains using aerial photography of the shadows thrown by special stakes is proposed. The procedure does not require knowledge of the flight altitude, the angles of elevation, the latitude of the station or the observation time. The possibility of using the method to determine the water level in the reservoirs and streams is indicated. Author

N74-21273 Joint Publications Research Service, Arlington, Va.
EXPERIMENT IN DETERMINING THE MOISTURE RESERVES IN THE SNOW COVER IN THE MOUNTAINS BY THE ABSORPTION OF GALACTIC COSMIC RADIATION

c13

S. I. Avdyushin, Yu. F. Barabanshchikov, R. M. Kogan, Yu. M. Kulagin, I. M. Nazarov, Sh. D. Fridman, and I. S. Yudkevich *In its* Meteorol. and Hydrol., No. 12, 1973 (JPRS-61632) 1 Apr. 1974 refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 12, 1973 p 98-102

The apparatus is described and the results are discussed from a prolonged experiment to determine the water reserves in the snow by recording galactic cosmic particle flux. It is demonstrated that with a moisture reserve range of 10-900 mm, the accuracy of measuring it by the absorption of the cosmic radiation is 34 mm. It is noted that the basic error in determining the moisture reserves arises from the diurnal variations of galactic cosmic radiation. A procedure is indicated for reducing this error. Author

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A74-19453 The application of two morphometric terrain-classification systems using air-photo interpretation methods. J. T. Parry and J. A. Beswick (McGill University, Montreal, Canada). *Photogrammetria*, vol. 29, Oct. 1973, p. 153-186. 15 refs. Research supported by the Defence Research Board of Canada.

A74-20001 Color: Theory and imaging systems. Edited by R. A. Eynard (Agfa-Gevaert, Inc., Teterboro, N.J.). Washington, D.C., Society of Photographic Scientists and Engineers, 1973. 448 p. Members, \$10.00; nonmembers, \$12.

The theory and history of color photography are described in sections dealing with classical processes, significant breakthroughs, inventions, and modern imaging systems. Attention is given to the response of the human eye, human color perception, colorimetry, color densitometry, color sensitometry, masking, color reproduction in color television, chemical fundamentals of color development, color reversal silver halide systems, silver dye bleach color copy materials, color films for aerial photography, generation of color imagery from ERTS data, color microfilming, and color xerography.

T.M.

A74-20004 * Generation of color imagery from earth resource technology satellite /ERTS/ data return. J. E. Polger (General Electric Co., Beltsville, Md.). In: Color: Theory and imaging systems. Washington, D.C., Society of Photographic Scientists and Engineers, 1973, p. 338-349. NASA-supported research.

The ERTS-1 satellite returns to the NASA-Goddard Ground Data Handling System four bands of Multispectral Scanner (MSS) imagery and three bands of Return Beam Vidicon (RBV) imagery. The system by which this data is used to generate multispectral color composite prints is described. The discussion includes an explanation of the ERTS photography tone reproduction system. (Author)

A74-20005 * Earth resources multispectral photography. J. H. Sasser (NASA, Johnson Space Center, Earth Observations Div., Houston, Tex.). In: Color: Theory and imaging systems. Washington, D.C., Society of Photographic Scientists and Engineers, 1973, p. 350-353.

The Skylab multispectral photographic facility has been designed to provide geometrically and photometrically calibrated imagery from space. The cameras and data analysis equipment will be described, and examples of automated analysis techniques under development will be shown. (Author)

A74-20076 Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1973. 806 p. Members, \$18.75; nonmembers, \$25.

New concepts in decision making, control, and adaptation are described together with applications to current problems in such areas as energy, transportation, information, communication, economics, and urban-social systems. Specific topics include Kalman filtering techniques, information patterns and classes of stochastic

control laws, computational methods for control problems, adaptive computer processing, observer algorithms, random variables in digital simulation, approximation methods in optimal control and mathematical programming, organizational systems, adaptive communications systems, decision algorithms in information theory, aircraft navigation and guidance, air traffic control, pattern recognition and interactive graphics, identification topics, and human decision making in automated control systems.

T.M.

A74-20094 * A Kalman filter approach to adaptive estimation of multispectral signatures. R. B. Crane (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings.

New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 371-373. 9 refs. Contract No. NAS9-9784.

The signatures of remote sensing data from agricultural crops exhibit significant non-stationarity, so that the performance of fixed parameter classifiers degenerates with time and distance from the initial training data. A class of adaptive decision-directed classifiers are being developed, based on Kalman filter theory. Limited results to date on two data sets indicate approximately a 25 to 40% reduction in rates of misclassification. (Author)

A74-20747 Test procedures for remote-sensing data. W. C. Draeger and D. M. Carneggie (California, University, Berkeley, Calif.). *Photogrammetric Engineering*, vol. 40, Feb. 1974, p. 175-181.

A need exists for the quantitative testing of remote-sensing interpretation results. Various steps are necessary for designing and administering interpretation tests, and problems are to be faced at each step. Quantitative interpretation test results permit an unbiased evaluation of remote sensing systems and other specification variables, and aid resource managers in deciding where remote-sensing techniques can be used in operational resource surveys. (Author)

A74-20749 Interpretation of orbital photographs. L. D. Carter and R. O. Stone (Southern California, University, Los Angeles, Calif.). *Photogrammetric Engineering*, vol. 40, Feb. 1974, p. 193-197.

Photographs of earth from orbiting spacecraft are inherently different from conventional aerial photographs. There are several orders of magnitude difference in scale, clouds viewed from above may be present and the photographs may neither approach a vertical view nor can stereoscopic study be easily achieved using Gemini and Apollo views. Because of such differences, recognition and interpretive procedures also are different. Forty-one black-and-white and color transparencies of the Gulf of California obtained from those missions were examined and interpretive procedures developed. It was found that tone and color are the photographic recognition elements most utilized for interpretation in oceanic areas. For study of terrestrial regions a combination of elements was applied, commonly tone, color and texture. Texture, because of the small scale of orbital imagery, is used to greater advantage than on conventional photographs. Size and scale are the two least used recognition elements. (Author)

A74-21341 * Adaptive on-line classification of multispectral scanner data. F. R. Fromm (Bell Telephone Laboratories, Inc., Naperville, Ill.) and R. A. Northouse (Wisconsin, University, Milwaukee, Wis.). In: International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings.

New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 155-158. 15 refs. Contract No. NAS12-931.

A possible solution to the analysis of the massive amounts of

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multi-spectral scanner data from the Earth Resource Technical Satellite (ERTS) program is proposed. This solution is offered as an adaptive on-line classification scheme. The classifier is described as well as its controller which is based on ground truth data. Cluster analysis is presented as an alternative approach to the ground truth data. Adaptive feature selection is discussed and possible mini-computer implementations are offered. (Author)

A74-21464 Airborne remote sensing calibration and correlation data. I. Y. Fitzgerald and R. C. Muirhead (NOAA, Rockville, Md.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 424-430, 5 refs.

Calibration and correlation data have been collected for airborne remote sensor surveys in four different areas. The areas include the South Carolina coast, Boston Harbor, Biscayne Bay, and a New Jersey coastal marsh. The sensors employed were metric, multi-spectral, and multiband cameras, single- and dual-channel infrared scanners, a multispectral scanner, and a digital photometric and polarimetric mapper. In the absence of adequate guidelines, minimum requirements for calibrating thermal infrared data to obtain absolute temperatures were established arbitrarily. G.R.

A74-21465 Terrain recognition in ERTS-1 imagery by diffraction pattern analysis. F. J. Corbett (Itek Corp., Lexington, Mass.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 431-436.

Terrain types from the ERTS-1 photography can be classified from spatial signatures. This paper describes the development of spatial signatures by analysis of the Fraunhofer diffraction patterns of selected ERTS images. The terrain types which are most appropriate for categorization by this method are: mountainous, urban, and cultivated areas. Signatures for cultivated land have been identified. A similar signature has been found for urban areas. Trends in signatures for mountainous terrain have been established. A Fourier plane filter has been developed. It has produced improved diffraction patterns and has greatly facilitated the terrain classification. Data collection and analysis procedures will be described. Examples of the ERTS imagery and corresponding diffraction patterns will be shown. (Author)

A74-22667 # Systems aspects of the digital simulation of satellites as required for the development and test of the group support software. R. E. Münch (ESRO, European Space Operations Centre, Darmstadt, West Germany). *ONERA and Institut de Recherche d'Informatique et d'Automatique, International Seminar on Simulation and Space, Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, Toulouse, France, Sept. 10-14, 1973, Paper. 28 p.*

Review of certain aspects of setting up a digital simulation system to support the development and testing of satellite-support software systems required for all attitude-related computations. Emphasis is placed on the areas of sensor and actuator characteristics, measurement and transmission errors, suitable dynamical model, nominal and abnormal behavior, backup procedures, etc. Various categories of simulation systems are highlighted, including systems used for testing mathematical models, data handling and task management, closed-loop performance (satellite/ground support software), etc. In conclusion, examples are given which illustrate the simulation concepts evolved from ESRO projects. (Author)

A74-23462 Direct additive printing. M. H. Kreitzer (Spectral Africa /Pty./, Ltd., Randfontein, Republic of South Africa). *Photogrammetric Engineering*, vol. 40, Mar. 1974, p. 281-283, 285.

The simultaneous gathering of imagery in more than one independent spectral channel has led to increasing demands for systems of data analysis capable of fully exploiting and displaying

the available information content of this type of imagery. Direct additive color printing is a viable technique for producing color composite imagery from multispectral separations using only conventional darkroom equipment. The end product is characterized by a large dynamic range and color gamut together with generally better band-to-band registration than is possible with conventional multiple-projection systems. F.R.L.

A74-24447 Digital processing and classification of ERTS multispectral pictures (Digitale Verarbeitung und Klassifizierung multispektraler ERTS-Bilder). G. Kritikos and E. E. Triendl (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Satellitenelektronik, Oberpfaffenhofen, West Germany). *Bildmessung und Luftbildwesen*, vol. 42, Mar. 1, 1974, p. 40-46. In German.

The ERTS multispectral scanner took pictures showing an area of about 185 by 185 square km in four spectral bands. Images showing the differences of various bands from one another and from a mean intensity value show details not visible in the original pictures. These difference images improve the recognition and classification of various natural features such as water, rock, clouds, ice, and vegetation. P.T.H.

A74-24449 The SDC multispectral viewer - A simple instrument for the interpretation of multispectral pictures (Der SDC-Farbmischprojektor - Ein einfaches Auswertegerät für Multispektralbilder). V. Kroesch (Bundesforschungsanstalt für Landeskunde und Raumordnung, Bad Godesberg, West Germany). *(Deutsche Gesellschaft für Photogrammetrie, Sitzung, Karlsruhe, West Germany, June 27, 1973.) Bildmessung und Luftbildwesen*, vol. 42, Mar. 1, 1974, p. 53-56, 5 refs. In German.

The construction and operation of the SDC multispectral viewer are explained. The visible and near IR spectral range is decomposed into four channels. Corresponding to each channel is a blue, green, red, or white filter. Color and false color renditions can be obtained through suitable choice of film-filter combinations. Pictures obtained by this instrument have shown details not present in conventional color and false color pictures. P.T.H.

A74-24967 * Latest results from the earth resources program. W. Nordberg (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Astronautical research 1972; Proceedings of the Twenty-third Congress, Vienna, Austria, October 8-15, 1972. Dordrecht, D. Reidel Publishing Co., 1973, p. 247-250, 9 refs.

The characteristics of optical measurements taken by the return-beam vidicon and multispectral scanner systems on the ERTS-1 satellite are described together with the interpretation of these observations for purposes of mapping and surveying earth resources over large areas. Each spectral interval covered by the sensors is discussed in terms of the type of features which can be discriminated and related to particular earth resources. T.M.

A74-25096 International Joint Conference on Pattern Recognition, 1st, Washington, D.C., October 30-November 1, 1973, Proceedings. Conference supported by the National Science Foundation. New York, Institute of Electrical and Electronics Engineers, Inc., 1973. 562 p. Members, \$18.75; nonmembers, \$25.

Mathematical methods are considered together with questions of character recognition, bio-medical applications, aspects of picture processing, and syntactic methods. Questions concerning adaptive speech recognition and synthesis are discussed together with the on-line recognition of speakers by machine, a similarity index between strings of symbols, a real-time optical speech analyzer, speech recognition in operational high-noise environments, and a real-time optical correlator. Subjects in the field of adaptive pattern recognition are also explored, giving attention to theory and applications.

G.R.

A74-25103 * Cloud type pattern recognition using environmental satellite data. A. L. Booth (NOAA, National Environmental Satellite Service, Washington, D.C.). In: International Joint Conference on Pattern Recognition, 1st, Washington, D.C., October 30-November 1, 1973, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 526-533. 17 refs. NASA Order S-70245-AG.

A classification analysis is conducted concerning the tropical cloud types as remotely sensed in the visual and infrared range by ITOS scanning radiometers. A statistical pattern recognition technique is used to examine the ability of coincident dual-channel and single-channel data to classify four main forms of clouds, including cumulus, stratocumulus, cumulonimbus, and cirrus. G.R.

A74-25389 * Operational earth resources data handling system for the 1980's. E. M. Van Vleck (NASA, Advanced Concepts and Missions Div., Moffett Field, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 57-73. 8 refs.

Results of a recent study of data handling requirements for future operational earth observation systems are reported. Such systems in the 1980's may have 10-20 meter resolution and generate .2 terabits of data per day, with peak rates of 0.8 gigabits per second based on the dominant requirements of agriculture. System alternatives are considered that will handle such data. Data relayed to the facility are recorded at high rates and then processed at lower speed by computer. Hardwired special digital logic computers may be used with an appropriate classification algorithm for crop recognition. Optical mass memories now in the prototype stage will handle the 10 terabits and 800 megabit per second read-in rate required. (Author)

A74-25412 Earth resource display resolution requirements. H. V. Soule (Lockheed Electronics Co., Inc., Houston Aerospace Systems Div., Houston, Tex.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 453-472. 20 refs.

The results of a number of investigations of display resolution requirements are presented. This includes a summary of the effects of gray level information, signal-to-noise ratio and color on resolution and one's ability to detect, recognize and identify targets. The resolution and viewing time requirements for moving scroll displays are also reviewed. (Author)

A74-25417 * Application of dielectric constant measurements to radar imagery interpretation. M. L. Bryan and R. W. Larson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 529-547. 41 refs. Contract No. NAS5-21783.

A ground-truth scheme is briefly outlined, specifically, the measurement of the dielectric constant. Two portable instruments were designed specifically for this purpose: a Q-meter for measurement of dielectric constant and loss tangent, and an instrument to measure electrical properties of the two operating frequencies of the imaging radar. Several general cases of radar-earth surfaces interaction are described; also, examples of radar imagery and some data on ice and snow are presented. F.R.L.

A74-25428 A comparison of multiband and multiemulsion imagery for automated land use discrimination. R. D. Mower (Center for Research, Inc., Lawrence, Kan.; USAF, Avionics Laboratory,

Wright-Patterson AFB, Ohio). In: Remote Sensing of Earth Resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 739-763. 7 refs. U.S. Geological Survey Contract No. 14-18-0001-12077; Grant No. DAAK02-68-C-0089. Project THEMIS.

Multiband and multiemulsion imagery were evaluated to determine which was best suited for automated land use interpretation. Density values for specified test sites were acquired using multiband blue, green, red and near infrared, and Ektachrome blue, green, red and near infrared imagery. These data were classified into major land use categories using a Bayesian clustering technique. Based upon these tests one would conclude that multiband imagery data are somewhat better than Ektachrome imagery data for land use discrimination. (Author)

A74-25437 * Time-lapse analysis of ERTS imagery using special electronic viewing/measuring equipment. W. E. Evans (Stanford Research Institute, Menlo Park, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 883-897. Contract No. NAS5-21841.

A74-26892 Data relay using ERTS-1. R. A. Halliday (Department of the Environment, Ottawa, Canada). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 225-236.

Nine ERTS data collection platforms have been installed at Water Survey of Canada gauging stations located in isolated parts of Canada. The purpose of this experiment is to see if satellite retransmission can be used to obtain near real time streamflow data from remote areas and to use any data obtained in this way for operational purposes. At present, water level data are transmitted from all sites and ice movement data from five sites. It is proposed that other sensor data including temperature, precipitation, ice thickness and river velocity will also be transmitted. The data collection system has proved to be very successful with many reliable transmissions being obtained each day from all sites. (Author)

A74-26898 Digital processing techniques in thermal plume analysis. R. W. Stingelin and G. B. Avis (HRB-Singer, Inc., State College, Pa.). In: Remote sensing and water resources management; Proceedings of the Symposium, Burlington, Ontario, Canada, June 11-14, 1973. Urbana, Ill., American Water Resources Association, 1973, p. 299-310. 10 refs.

The Reconofax XVI airborne scanning radiometer is used to collect infrared data of the thermal plume from the Connecticut Yankee Nuclear Power Plant. Operational in the 8-12 micrometer region, the system uses two controllable blackbody reference sources to provide calibrated data on analog magnetic tape. The analog tapes are subsequently digitized in a signal processing facility using a 256 8-bit byte, high-speed shift register with the output being digital magnetic tapes. Analysis and display of the infrared data is accomplished through use of a Computek interactive graphic system attached to a digital computer. Data may be displayed in a variety of ways, including grey shades, isotherm maps, and radiometric profiles. Analytical computer routines may be run with the data to perform statistical analysis, scene correction, residual analysis, and thermal modeling. (Author)

A74-27537 Spatial resolution of ERTS images by computer. A. McLellan and W. Kuhlrow (Wisconsin, University, Madison, Wis.). *Nature*, vol. 248, Apr. 5, 1974, p. 479, 480.

The feasibility of a man-computer interactive data access system

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

(McIDAS) has been demonstrated. The system considered has rapid data storage, access, display, and analysis techniques applicable to many areas of satellite data processing. Results presented from McIDAS show the spatial resolution which can be obtained from ERTS-1 digital data by the display of urban images appropriate for identification of land use. G.R.

A74-28027 * ERTS operations and data processing. L. Gonzales and J. Y. Sos (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Environmental Sciences*, vol. 17, Mar.-Apr. 1974, p. 16-22.

The overall communications and data flow between the ERTS spacecraft and the ground stations and processing centers generally described. Data from the multispectral scanner and one return beam vidicon are telemetered to a primary ground station where they are demodulated, processed, and recorded. The tapes are then transferred to the NASA Data Processing Facility (NDPF) at Goddard. Housekeeping data are relayed from the prime ground stations to the Operations Control Center at Goddard. Tracking data are processed at the ground stations, and the calculated parameters are transmitted by teletype to the orbit determination group at Goddard. The ERTS orbit has been designed so that the same swaths of the ground coverage pattern viewed during one 18-day coverage cycle are repeated by the swaths viewed on all subsequent cycles. The Operations Control Center is the focal point for all communications with the spacecraft. NDPF is a job-oriented facility which processes and stores all sensor data, and which disseminates large quantities of these data to users in the form of films, computer-compatible tapes, and data collection system data. P.T.H.

A74-28348 A practical method to transform ERTS-1 imagery for mosaicking on Albers equal-area projection. R. M. Hooper (U.S. Department of Agriculture, Soil Conservation Service, Hyattsville, Md.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 589-606.

A74-28349 * A general solution for the registration of optical multispectral scanners. M. L. Rader (Lockheed Electronics Co., Inc.; NASA, Johnson Space Center, Houston, Tex.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 608-616.

The paper documents a general theory for registration (mapping) of data sets gathered by optical scanners such as the ERTS satellite MSS and the Skylab S-192 MSS. This solution is generally applicable to scanners which have rotating optics. Navigation data and ground control points are used in a statistically weighted adjustment based on a mathematical model of the dynamics of the spacecraft and the scanner system. This adjustment is very similar to the well known photogrammetric adjustments used in aerial mapping. Actual tests have been completed on NASA aircraft 24 channel MSS data, and the results are very encouraging. (Author)

A74-28350 * Absolute spatial registration of Skylab S192 conical scanner imagery by means of dynamic geometrical modeling. R. C. Malhotra (Lockheed Electronics Co., Inc.; NASA, Johnson Space Center, Houston, Tex.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 617-629.

A74-29335 # Effectiveness of light-beam conversion by means of dynamic three-dimensional phase holograms (Ob effektivnosti preobrazovaniia svetovykh puchkov s pomoshch'iu dinamicheskikh ob'emnykh fazovykh gologramm). D. I. Stasel'ko and V. G. Sidorovich. *Zhurnal Tekhnicheskoi Fiziki*, vol. 44, Mar. 1974, p. 580-587. 7 refs. In Russian.

The effectiveness of the energy transfer between waves propagating in dynamic phase holograms is analyzed. It is shown that under certain conditions, almost the entire energy of one of the light beams incident on the hologram can be transferred to another beam, regardless of their initial intensities. V.P.

N74-15892# Engins Matra, Velizy (France). **STUDY ON AN ERAF DATA PREPROCESSING FACILITY. VOLUME 1: INTRODUCTION AND REVIEW OF PREPROCESSING METHODS**

G. E. Lowitz and J. C. Guillen Jul. 1973 114 p refs (Contract ESTEC-1762/72-PP) (ESRO-CR(P)-300) Avail: NTIS HC \$7.75

The scope and objectives of the earth resources aircraft facility study are reviewed and the major requirements discussed. The sensors to be used are considered and the general study methodology outlined. Data processing requirements and methods are described and possible pre-processing operations, e.g. data acquisition and correction, are discussed. Format conversion is considered and display requirements and data indexing and retrieval are noted. ESRO

N74-15893# Engins Matra, Velizy (France). **STUDY OF AN ERAF DATA PREPROCESSING FACILITY. VOLUME 2: ERAF DATA FLOW**

G. E. Lowitz and J. C. Guillen Jul. 1973 155 p (Contract ESTEC-1762/72-PP) (ESRO-CR(P)-301) Avail: NTIS HC \$9.75

The data flow in the earth resources aircraft facility ground station is presented. Input and output formats are described and the choice of preprocessing operations discussed. The various processing modules are described in detail together with implementation and interfaces. Typical ERAF processing chains are given illustrating the data flow tuning and the open shop usage. ESRO

N74-15894# Engins Matra, Velizy (France). **STUDY OF AN ERAF DATA PREPROCESSING FACILITY. VOLUME 3: ERAF SOFTWARE**

Q. S. Earl (Plessey Radar Co.) Jul. 1973 183 p ref (Contract ESTEC-1762/72-PP) (ESRO-CR(P)-302) Avail: NTIS HC \$11.25

The software needs for the various steps and system requirements of the Earth Resources Survey Aircraft are detailed. The aspects covered include preliminary processing: ADAS processing; bulk processing; calibration and corrections; output processing and software cost, size and timing. ESRO

N74-15895# Engins Matra, Velizy (France). **STUDY ON AN ERAF DATA PREPROCESSING FACILITY. VOLUME 4: ERAF IMPLEMENTATION AND COSTS. STUDY CONCLUSION**

M. Fuentes Losa (Sener), G. E. Lowitz, and J. C. Guillen Jul. 1973 67 p refs (Contract ESTEC-1762/72-PP) (ESRO-CR(P)-303) Avail: NTIS HC \$5.50

The equipment requirements for the ground station of the earth resources aircraft facility are reviewed and evaluated. These include both data processing, photographic and television equipment. The building is considered, the architectural and furniture costs are noted and the electrical power, air conditioning

and fire protection requirements are discussed. The station personnel are also discussed. A typical cost breakdown is given showing recurrent and non-recurrent costs. ESRO

N74-16014* Michigan State Univ., East Lansing.
INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Dec. 1973
Lester V. Manderscheid, Principal Investigator Dec. 1973 3 p EREP
(Contract NAS9-13332)
(E74-10253; NASA-CR-136567) Avail: NTIS HC \$3.00 CSCL 05B

N74-16020* Cornell Univ., Ithaca, N.Y. Resource Information Lab.
PHOTOGRAPHIC ENHANCEMENT OF ERTS IMAGERY Progress Report
Ernest E. Hardy, Principal Investigator and E. S. Phillips 15 Jan. 1974 44 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21886)
(E74-10259; NASA-CR-136587) Avail: NTIS HC \$4.25 CSCL 05B

N74-16023* Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Jan. 1974
Richard F. Nalepka and William A. Malila, Principal Investigators 6 Feb. 1974 2 p EREP
(Contract NAS9-13280)
(E74-10262; NASA-CR-136684; ERIM-101900-23-L; MPR-11) Avail: NTIS HC \$3.00 CSCL 05B

N74-16026* Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Process Report, 1 Nov. 1973 - 1 Jan. 1974
P. N. Slatte, Principal Investigator, R. L. Antos, and R. A. Schowengerdt Dec. 1973 13 p ERTS
(Contract NAS5-21849)
(E74-10277; NASA-CR-136663; PR-8) Avail: NTIS HC \$3.00 CSCL 05B

N74-16060* Michigan Univ., Ann Arbor. Infrared and Optics Lab.
INFORMATION EXTRACTION TECHNIQUES FOR MULTI-SPECTRAL SCANNER DATA
W. A. Malila, R. B. Crane, and R. E. Turner Jun. 1972 199 p refs
(Contract NAS9-9784)
(NASA-CR-134180; WRL-31650-74-T) Avail: NTIS HC \$12.00 CSCL 05B

The applicability of recognition-processing procedures for multispectral scanner data from areas and conditions used for programming the recognition computers to other data from different areas viewed under different measurement conditions was studied. The reflective spectral region approximately 0.3 to 3.0 micrometers is considered. A potential application of such techniques is in conducting area surveys. Work in three general areas is reported: (1) Nature of sources of systematic variation in multispectral scanner radiation signals, (2) An investigation of various techniques for overcoming systematic variations in scanner

data; (3) The use of decision rules based upon empirical distributions of scanner signals rather than upon the usually assumed multivariate normal (Gaussian) signal distributions. Author

N74-16061* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB 3: PHOTOGRAPHIC INDEX AND SCENE IDENTIFICATION
Richard W. Underwood and John W. Holland Nov. 1973 257 p
(NASA-TM-X-69780; JL12-602) Avail: NTIS HC \$15.00 CSCL 05B

A quick reference guide to the photographic imagery obtained on Skylab 3 is presented. Place names and descriptors are used for frame identification. Author

N74-17062* Kansas State Univ., Manhattan. Evapotranspiration Lab.
FLEXIBLE DCP INTERFACE
E. T. Kanemasu, Principal Investigator and H. Schimmelpennig [1974] 24 p ref ERTS
(Contract NAS5-21822)
(E74-10268; NASA-CR-136654; Contrib-1397; Rept-226-3) Avail: NTIS HC \$3.25 CSCL 05B

The author has identified the following significant results. A user of an ERTS data collection system must supply the sensors and signal conditioning interface. The electronic interface must be compatible with the NASA-furnished data collection platform (DCP). A universal signal conditioning system for use with a wide range of environmental sensors is described. The interface is environmentally and electronically compatible with the DCP and has operated satisfactorily for a complete winter wheat growing season in Kansas.

N74-17064* Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Dec. 1973
Richard F. Nalepka and William A. Malila, Principal Investigators 24 Jan. 1974 2 p EREP
(Contract NAS9-13280)
(E74-10270; NASA-CR-136656; ERIM-101900-22-L; MPR-10) Avail: NTIS HC \$3.00 CSCL 05B

N74-17069* Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-A IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report, 25 Nov. 1973 - 25 Jan. 1974
Robert E. Bodenheimer, Principal Investigator 5 Feb. 1974 2 p ERTS
(Contract NAS5-21875)
(E74-10275; NASA-CR-136661) Avail: NTIS HC \$3.00 CSCL 05B

N74-17102* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Jan. 1974
Roger M. Hoffer, Principal Investigator Jan. 1974 7 p EREP
(Contract NAS9-13380)
(E74-10315; NASA-CR-136805) Avail: NTIS HC \$4.00 CSCL

N74-17154# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

PRODUCING HIGH-QUALITY NEGATIVES FROM ERTS BLACK-AND-WHITE TRANSPARENCIES

Richard J. Myhre 1973 6 p refs
(PSW-287) Avail: NTIS HC \$4.00

A method was devised for producing high-quality black-and-white negatives quickly and efficiently from dense transparencies originating from Earth Resources Technology Satellite imagery. Transparencies are evaluated on a standard light source to determine exposure and processing information needed for making negatives. A System ASA Rating was developed by testing and selecting combinations of film, light sources, and developer. Changes in film density and contrast of negatives owing to reciprocity effects are controlled by calculating adjustments in exposure and development. The method described can be used in relatively small darkrooms without expensive equipment. Its usefulness was demonstrated in a high-altitude photo mission over the Black Hills National Forest, South Dakota. Author

N74-17565*# Operations Research, Inc., Silver Spring, Md.
ON BOARD SATELLITE PROCESSING STUDY Final Report

D. L. Reed May 1973 107 p refs
(Contract NAS5-21645)

(NASA-CR-132931; TR-771) Avail: NTIS HC \$8.50 CSCL 22B

The use of satellite-based, world-wide data collection and location systems for scientific purposes is discussed. The configuration of satellite borne data handling equipment to prevent premature saturation and to provide maximum capacity without degradation of performance is described. An analysis of a data collection and location system based on random time and frequency access to the satellite was conducted. The subjects presented are: (1) a general description of the concept of a random access system, (2) the quantitative characteristics of random access systems, and (3) the development of a model for comparing the various types of digital communications systems. Author

N74-18017*# Boeing Co., Kent, Wash.

QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Jul. 1973

David L. Tingey, Principal Investigator Jul. 1973 2 p EREP
(Contract NAS9-13303)

(E74-10341; NASA-CR-136853) Avail: NTIS HC \$4.00 CSCL 04A

N74-18031* California Univ., Davis. Dept. of Electrical Engineering.

MULTISPECTRAL COMBINATION AND DISPLAY OF ERTS-1 DATA Special Study No. 2

Vidal Raphael Algazi In its An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 31 Dec. 1973 9 p refs

CSCL 05B

A significant problem in the use of ERTS-1 data is the extraction of information pertinent to each application and the presentation of that information in a form most suitable to users. When the information is to be displayed for visual study by an observer, the problem can be reduced to two steps: (1) Dimensionality reduction, an objective procedure which attempts to preserve most of the ERTS-1 information in a smaller number of components. (2) Display of the reduced number of components for optimum visibility by an observer. A specific dimensionality reduction technique has been applied to ERTS-1 data for several geographical areas in California and distinct types of earth resources. In the display of the reduced number of components, consideration has to be given to properties of the

human visual system and the statistics of the data to be displayed. Previous work on digital image enhancement was applied to this problem to generate color composites which contain and display most of the information provided by the ERTS-1 sensors. Results of this approach were interesting, both in terms of the small mean-square caused by the dimensionality reduction, as well as for the examples of enhanced images that have been obtained. Author

N74-18055# Telespazio, S.p.A., Rome (Italy).

DATA PREPROCESSING SYSTEMS FOR EARTH RESOURCES SURVEYS. VOLUME 1: INTRODUCTION TO PREPROCESSING TECHNIQUES

G. Bressanin, J. Erickson et al Paris ESRO Sep. 1973 260 p refs Prepared jointly with Environ. Res. Inst. of Mich. 5 Vol. (Contract ESTEC-1761/72)

(ESRO-CR-295-Vol-1) Avail: NTIS HC \$16.00

Data preprocessing systems as implemented in the framework of a remote sensing information system are reviewed. A description of remote sensors used in gathering earth resources data is presented, giving for each various criteria such as formats, calibration, and correction techniques. Data manipulation techniques such as photographic techniques or analog to digital conversion which precede the data processing proper are described together with data compression methods. Geometric manipulation and image data, preprocessing are covered with several application examples. Feature extraction and classification processing are also considered. ESRO

N74-18056# Telespazio, S.p.A., Rome (Italy).

DATA PREPROCESSING SYSTEMS FOR EARTH RESOURCES SURVEYS. VOLUME 2: METHODS OF IMPLEMENTATION

G. Bressanin, J. Erickson et al Paris ESRO Sep. 1973 188 p refs Prepared jointly with Environ. Res. Inst. of Mich. 5 Vol. (Contract ESTEC-1761/72)

(ESRO-CR-296-Vol-2) Avail: NTIS HC \$12.50

The significant features and requirements of an operational remote sensing information system are described along with the effects of these requirements on the implementation of such a system. Problems encountered in the implementation of algorithms by means of digital, analog and hybrid computers are discussed. The major software packages available for image data processing are reviewed and aspects of data storage and retrieval are discussed. Finally two illustrated examples of data processing systems are given - one on a multispectral scanner and the other on the coherent optical processing of geographical imagery. ESRO

N74-18057# Telespazio, S.p.A., Rome (Italy).

DATA PREPROCESSING SYSTEMS FOR EARTH RESOURCES SURVEYS. VOLUME 3: TECHNICAL APPENDICES

G. Bressanin, J. Erickson, G. Arlette et al Paris ESRO Sep. 1973 91 p refs Prepared jointly with Environ. Res. Inst. of Mich. and Centre d'Informatique Geol. of Ecole Natl. Super. des Mines, Paris 5 Vol. (Contract ESTEC-1761/72)

(ESRO-CR-297-Vol-3) Avail: NTIS HC \$7.75

Specific mathematical aspects of data processing techniques for remote sensing applications are illustrated. Among the aspects covered are image data processing, signature extension techniques, entropy reduction, classification of unresolved objects and sea state optical processing. ESRO

N74-18058# Telespazio, S.p.A., Rome (Italy).

DATA PREPROCESSING SYSTEMS FOR EARTH RESOURCES SURVEYS. VOLUME 4: SUMMARY [SYSTEMES DE PRELABORATION DE DONNEES POUR LA TELEDETECTION DES RESSOURCES TERRESTRES. VOL. 4: SOMMAIRE]

G. Bressanin and J. Erickson Paris ESRO Sep. 1973 31 p In FRENCH; ENGLISH summary Prepared jointly with Environ.

Res. Inst. of Mich. 5 Vol.
(Contract ESTEC-1761/72)
(ESRO-CR-298-Vol-4) Avail: NTIS HC \$4.75

Data preprocessing systems implemented in a remote sensing information system are given. Data acquisition, data manipulation and compression, imaging techniques, extraction of characteristics, and optical data processing. ESRO

N74-18962* Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Feb. 1974
David L. Tingey, Principal Investigator Feb. 1974 1 p EREP
(Contract NAS9-13303)
(E74-10353; NASA-CR-137038) Avail: NTIS HC \$4.00 CSCL 04A

N74-18978* Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Dec. 1973
David L. Tingey, Principal Investigator Dec. 1973 1 p EREP
(Contract NAS9-13303)
(E74-10369; NASA-CR-137063) Avail: NTIS HC \$4.00 CSCL 04A

N74-18980* Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Feb. 1974
Richard F. Nalepka and William A. Malila, Principal Investigators
14 Mar. 1974 2 p EREP
(Contract NAS9-13280)
(E74-10371; NASA-CR-137068; ERIM-101900-26-L; MPR-12) Avail: NTIS HC \$4.00 CSCL 05B

N74-18985* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Feb. 1974
Roger M. Hoffer, Principal Investigator Feb. 1974 5 p EREP
(Contract NAS9-13380)
(E74-10376; NASA-CR-137073) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. One capability which has been recognized by many geologists working with space photography is the ability to see linear features and alignments which were previously not apparent. To the exploration geologist, major lineaments seen on satellite images are of particular interest. A portion of ERTS-1 frame 1407-17193 (3 Sept. 1973) was used for mapping lineaments and producing an iso-lineament intersection map. Skylab photography over the area of prime area was not useable due to snow cover. Once the lineaments were mapped, a grid with 2.5 km spacing was overlaid on the map and the lineament intersections occurring within each grid square were counted and the number plotted in the center of the grid square. These numbers were then contoured producing a contour map of equal lineament intersection. It is believed that the areas of high intersection concentration would be the most favorable area for ore mineralization if favorable host rocks are also present. These highly fractured areas would act as conduits for carrying the ore forming solutions to the site of deposition in a favorable host rock. Two of the six areas of high intersection concentration are over areas of present or

past mining camps and small claims are known to exist near the others. These would be prime target areas for future mineral exploration.

N74-18995* Stanford Univ., Calif. School of Earth Sciences.
MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURE USING NESTED SAMPLING APPROACH Progress Report, 3 Jan. - 3 Mar. 1974
R. J. P. Lyon and F. R. Honey, Principal Investigators 3 Mar. 1974 28 p ERTS
(Contract NAS5-21884)
(E74-10386; NASA-CR-137204) Avail: NTIS HC \$4.50 CSCL 05B

N74-18996* Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Nov. 1973
David L. Tingey, Principal Investigator Nov. 1973 1 p EREP
(Contract NAS9-13303)
(E74-10387; NASA-CR-137205) Avail: NTIS HC \$4.00 CSCL 04A

N74-19009* TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Final Report and Semiannual Progress Report
John E. Taber, Principal Investigator, S. S. Rifman, and D. M. McKinnon Mar. 1974 80 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21814)
(E74-10401; NASA-CR-137225; TRW-20634-6003-TU-00) Avail: NTIS HC \$7.00 CSCL 05B

N74-19015* Kanner (Leo) Associates, Redwood City, Calif.
A FEW CONSIDERATIONS ON THE ERTS NO. 1 PICTURES OF THE WET PAMPA AREA: THE REPUBLIC OF ARGENTINA
Oscar Dominguez Washington NASA Mar. 1974 14 p Transl. into ENGLISH from the Argentine report
(Contract NASw-2481)
(NASA-TT-F-15451) Avail: NTIS HC \$4.00 CSCL 08F

Factors, such as cloud cover and land surface area, which affected the ERTS-1 aerial photographs of the Wet Pampa Area of Argentina are discussed. The advantages and disadvantages of using remote sensing for photography rather than ground-based photography are discussed. A chart is included showing the orbits of ERTS-1 and the number of pictures taken. K.M.M.

N74-19796* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TECHNOLOGY FORECASTING FOR SPACE COMMUNICATION Final Report
Jun. 1973 508 p
(Contract NAS5-22057)
(NASA-CR-132936; SCG-40001R) Avail: NTIS HC \$28.50 CSCL 17B

A study was conducted to determine techniques for application to space communication. The subjects considered are as follows: (1) optical communication systems, (2) laser communications for data acquisition networks, (3) spacecraft data rate requirements, (4) telemetry, command, and data handling, (5) spacecraft tracking and data network antenna and preamplifier cost tradeoff study, and (6) spacecraft communication terminal evaluation.

N74-19800* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.

TASK FOUR REPORT: TELEMETRY, COMMAND, AND DATA HANDLING

In its Technology Forecasting for Space Communication Jun. 1973 112 p refs

(SCG-30174R) CSCL 09F

An overview of the telemetry, command, and data handling features of four spacecraft developed under GSFC management is presented. Two of these spacecraft ATS and SMS, are designed for geostationary orbit; the other two OSO and ERTS, are designed for low earth orbits. The program time spans for these spacecraft are as shown. The programs are seen to be near contemporary, especially in the 1973, 1974 period. All of the spacecraft listed were developed under GSFC control and are thus subject to the standards set forth in the Aerospace Data System Standard developed by GSFC. These standards must be adhered to by all spacecraft programs under GSFC control or utilizing STDN unless waivers have been granted. The standards were developed to maximize the utilization of the large amount of standard equipment at each STDN ground facility. The standards impose bounds on both the command and telemetry formats to be compatible with the STDN ground station unless valid and acceptable reasons are raised to deviate from these restraints. Author

N74-19945*# Argus Exploration Co., Los Angeles, Calif.
INVESTIGATION OF A LINEAMENT EXPRESSED IN AN OBLIQUE APOLLO 9 PHOTOGRAPH

Mark A. Liggett, Principal Investigator and Jack W. Barth Mar. 1974 9 p refs ERTS

(Contract NAS5-21809)

(E74-10410; NASA-CR-137255) Avail: NTIS HC \$4.00 CSCL 14E

The author has identified the following significant results. A linear topographic feature, referred to as the New York Mountains lineament, was recognized in an oblique Apollo 9 photograph to extend from the Providence Mountains of California to near Lake Mead, Arizona. In subsequent vertical ERTS-1 imagery this feature was found to have vague and indistinct expression. A study was conducted to determine the possible geologic origin(s) of the lineament and to explain its anomalous expression in the Apollo 9 photograph. The results suggest that the apparent expression of the lineament is due to a combination of the oblique view of the Apollo photograph, low sun angle illumination of southeast facing slopes, shadowing of northwest facing slopes, and linear snow line along the southeastern flank of the New York Mountains. No geologic or structural causes for the lineament have been found.

N74-19957*# Ecosystems International, Inc., Gambrills, Md.
SYNTHESES AND ANALYSES OF EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) PROGRAM DATA Quarterly Informal Progress Report

Peter A. Castruccio 5 Apr. 1974 37 p ERTS

(Contract NASw-2488)

(E74-10427; NASA-CR-137353) Avail: NTIS HC \$5.00 CSCL 02C

N74-20624*# Environmental Research Inst. of Michigan, Ann Arbor.

INVESTIGATIONS IN ADAPTIVE PROCESSING OF MULTISPECTRAL DATA Technical Report, 1 Nov. 1971 - 31 Jan. 1973

F. J. Kriegler and H. M. Horwitz Aug. 1973 36 p refs

(Contract NAS9-9784)

(NASA-CR-134223; ERIM-31650-151-T) Avail: NTIS HC \$5.00 CSCL 05B

Adaptive data processing procedures are applied to the problem of classifying objects in a scene scanned by multispectral sensor. These procedures show a performance improvement over standard nonadaptive techniques. Some sources of error in

classification are identified and those correctable by adaptive processing are discussed. Experiments in adaptation of signature means by decision-directed methods are described. Some of these methods assume correlation between the trajectories of different signature means; for others this assumption is not made.

Author

N74-20963*# East Anglia Univ., Norwich (England). School of Environmental Sciences.

DESIGN AND EVALUATION OF A COMPUTER BASED SYSTEM TO MONITOR AND GENERALISE, BY AREAS, DATA FROM ERTS PRECISION IMAGERY TAPES Progress Report, 23 Jul. 1973 - 22 Jan. 1974

Keith M. Clayton, Principal Investigator Mar. 1974 89 p refs Sponsored by NASA ERTS

(E74-10436; NASA-CR-137387) Avail: NTIS HC \$7.50 CSCL 08B

N74-20964*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

EMISSION AND REFLECTION FROM HEALTHY AND STRESSED NATURAL TARGETS WITH COMPUTER ANALYSIS OF SPECTRORADIOMETRIC AND MULTISPECTRAL SCANNER DATA

Ravindra Kumar and LeRoy F. Silva Dec. 1973 238 p refs

(Grant NGL-15-005-112)

(NASA-CR-137427; LARS-072473; TR-EE-73-37) Avail: NTIS HC \$15.00 CSCL 06C

Special emphasis was on corn plants, and the healthy targets were differentiated from stressed ones by remote sensing. Infrared radiometry of plants is reviewed thoroughly with emphasis on agricultural crops. Theory and error analysis of the determination of emittance of a natural target by radiometer is discussed. Experiments were conducted on corn (*Zea mays* L.) plants with long wavelength spectroradiometer under field conditions. Analysis of multispectral scanner data of ten selected flightlines of Corn Blight Watch Experiment of 1972 indicated: (1) There was no regular pattern of the mean response of the higher level/levels blighted corn vs. lower level/levels blighted corn in any of the spectral channels. (2) The greater the difference between the blight levels, the more statistically separable they usually were in subsets of one, two, three and four spectral channels.

Author

N74-21602 Wisconsin Univ., Madison.

A PRACTICAL CATALOGING, INDEXING, AND RETRIEVAL SYSTEM FOR REMOTE SENSING DATA Ph.D. Thesis

Ramchandra Sitaram Singh 1973 162 p

Avail: Univ. Microfilms Order No. 73-23088

A system was designed whereby the remote sensing data which includes imagery, flight-logs, ground-truth and research reports which contain raw data can be properly cataloged, indexed, and retrieved from the remote sensing user's point of view. The mechanics can be handled by a librarian with a minimal amount of orientation to remote sensing. The system is basically designed for low altitude (about 10,000 ft. or less) imagery but has the capability of being adapted for any altitude imagery or for ground, laboratory, or underwater shots and related documents containing raw data. This practical cataloging, indexing, and retrieval system for remote sensing data consists of the following: (1) A card catalog; (2) A site-index-map; and (3) site-index-file; industry-index-file; project-index-file; and catalogue cards. Dissert. Abstr.

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A74-19311 * Remote monitoring of the atmosphere with Raman LIDAR. S. H. Melfi (NASA, Langley Research Center, Hampton, Va.). In: NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973, p. 31-33.

Some of the Raman LIDAR applications for monitoring the atmosphere are reviewed. Following a definition of Raman scattering, the basic design of a Raman LIDAR system is described and the atmosphere-monitoring potentialities and limitations of the system are discussed, along with the possibilities of further progress. M.V.E.

A74-19314 Synthetic aperture radar for the study of earth resources. L. C. Graham (Goodyear Aerospace Corp., Litchfield Park, Ohio). In: NEREM 73; Northeast Electronics Research and Engineering Meeting, Boston, Mass., November 6-8, 1973, Record. Part 1. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1973, p. 92-95.

Discussion of the principle of operation and earth resource applications of airborne terrain-imaging synthetic aperture radar. One of the advantages pointed out is that radar provides its own illumination and images are obtainable at any time, which makes possible the recording of transient conditions at critical times without waiting for favorable weather and sunlight. Another advantage is that the longer wavelengths and unique geometry of radar emphasize topographic and geologic features differently from other airborne sensors and often can provide data barely obtainable with those other sensors. M.V.E.

A74-19465 Remote sensing of the earth by microwaves. K. Tomiyasu (GE Valley Forge Space Center, Philadelphia, Pa.). *IEEE, Proceedings*, vol. 62, Jan. 1974, p. 86-92. 142 refs.

Extant techniques for remotely sensing the earth with instruments operating at microwave frequencies are surveyed. Microwave sensors can provide day-night operation and almost an all-weather capability due to higher transmission through clouds at microwave than at visible or infrared wavelengths. Passive (radiometers), active (radars, altimeters, and scatterometers), and composite (passive-active) microwave sensors are in use or planned for such diverse applications as measuring ocean surface dynamics, ocean salinity, soil moisture content, atmospheric temperature and atmospheric constituents; detecting sea ice, oil slicks, and storm cells; and identifying agricultural crops. These measurements have been taken with sensors located in towers, aircraft, and most recently satellites. (Author)

A74-19473 # The use of the pressurized balloon for detecting energy resources (L'impiego del pallone pressurizzato der il rilevamento delle risorse di energia). A. Castellani (CNR, Rome, Italy) and S. Vetrella (Centro Applicazioni Tecnologie Aerospaziali, Naples, Italy). *Istituto Internazionale delle Comunicazioni, Convegno Internazionale delle Comunicazioni, 21st, Genoa, Italy, Oct. 8-13, 1973, Paper. 20 p.* In Italian.

Discussion of the use of pressurized plastic balloons for the detection of energy resources. The balloon system to be employed is

compared to aircraft, sounding rocket, and satellite systems. The remote sensors which could be used with a balloon system for earth resources surveys are described. The physics of pressurized balloons are analyzed to determine their performances. (Author)

A74-20746 * Viewing-angle effects in radar images. T. A. Eppes and J. W. Rouse, Jr. (Texas A & M University, College Station, Tex.). *Photogrammetric Engineering*, vol. 40, Feb. 1974, p. 169-173. 5 refs. Grant No. NGL-44-001-001.

A quantitative determination of the effect of viewing angle on the detectability of topographic linears in radar imagery is presented. Variations of azimuth and aspect angles of an imaging radar antenna relative to a topographic linear were simulated using low-angle illumination of controlled linear features on polystyrene sheets. The several model surfaces represented idealized versions of surface types that may be expected in areas of geologic interest. Fourier transform spectra of the radar image simulations were obtained using a coherent-optics system. These spectra were found to correlate with a detectability factor obtained directly from the radar image simulations. Fourier transform spectra of a linear feature observed from multiple viewing angles by a K-band imaging radar were also obtained and a detectability factor was estimated which agreed closely with theoretical predictions. (Author)

A74-20859 Recent advances in electron beam recording. P. F. Grosso and A. A. Tarnowski (CBS Laboratories, Stamford, Conn.). (Symposium on Electron, Ion, and Laser Beam Technology, 12th, Cambridge, Mass., May 21-23, 1973.) *Journal of Vacuum Science and Technology*, vol. 10, Nov.-Dec. 1973, p. 926-931.

This article describes recent advances in electron-beam recorders (EBR) which utilize the inherent flexibility of electron beams and computer control for a variety of applications such as remote sensor imagery, computer micrographics, microelectronics, and other high resolution digital and analog imagery. These advanced electron beam recorders can be used on-line with computers or remote sensors, or off-line with analog or digital magnetic tape inputs, in a variety of scanning modes using computer control. (Author)

A74-20988 Electro-Optical Systems Design Conference, 5th, New York, N.Y., September 18-20, 1973, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1973. 403 p. \$25.

Design and performance characteristics of vertical temperature profile radiometers for atmospheric temperature soundings, improvements and applications of pyroelectric detectors, and photoconductive detectors using thin films of Pb-Sn chalcogenide alloy are among the topics covered in papers concerned with advances in infrared detectors. Other areas covered include advances in wideband photooptical recording, low-light-level television systems, and applications of optical processing to biomedical images. M.V.E.

A74-20995 * Very high resolution radiometer /VHRR/. A. I. Aronson (RCA, Astro-Electronics Div., Princeton, N.J.). In: Electro-Optical Systems Design Conference, 5th, New York, N.Y., September 18-20, 1973, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1973, p. 154-162. 6 refs. Contract No. NAS5-10306.

Discussion of the design and performance of the very high resolution radiometer (VHRR) representing the first of a second-generation of infrared scanning radiometers of high performance. Following a description of the optical, signal-electronics, sync-generator, scan-drive, cooler, and contamination-protection design, it is pointed out that the two VHRRs presently operating have logged a total of 15,500 hrs of continuous successful operation since launch. The cooler operation has been particularly noteworthy. The cold plate heater power, required to maintain the detectors at 105 K, has

undergone in almost a year's operation so small a degradation as to indicate a VHRR cooler lifetime exceeding the instrument design lifetime of one year by a large margin. High resolution, low noise, and jitter-free pictures are shown to have been derived from these instruments. M.V.E.

A74-21006 Atmospheric compensation in remote sensing. J. C. Bryner (Rockwell International Corp., Downey, Calif.). In: Electro-Optical Systems Design Conference, 5th, New York, N.Y., September 18-20, 1973, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1973, p. 342-349, 8 refs.

A recurring problem in interpreting remotely-sensed data involves the perturbing effects of the atmosphere. These effects must be compensated for if unique spectral signatures are to be recognized from the air or from space under all atmospheric conditions. Atmospheric compensation is usually accomplished by modeling. This paper outlines a new method of atmospheric compensation that is simple enough to be implemented with a minimum of equipment and yet accurate enough to permit quantitative reflectance measurements of ground based objects from the air or from space. An example is worked out using ERTS-A data to show the quality of the results one might expect to achieve. T.M.

A74-21401 * The Nimbus 4 infrared spectroscopy experiment. II - Comparison of observed and theoretical radiances from 425-1450 wavelengths/cm. V. G. Kunde, B. J. Conrath, R. A. Hanel, W. C. Maguire, C. Prabhakara, and V. V. Salomonson (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research*, vol. 79, Feb. 20, 1974, p. 777-784, 17 refs.

The Nimbus 4 infrared interferometer spectrometer (IRIS) measured the thermal emission of the earth's atmosphere and surface from 400-1600 wavelengths/cm with an apodized spectral resolution of 2.8 wavelengths/cm. A comparison of theoretical radiances, computed from in situ measurements and using a direct integration slant path atmospheric transmittance model, with the observed IRIS radiances has been made to verify the radiometric and spectral performance of the instrument and to assess the accuracy of the atmospheric transmittances. The radiance comparison has indicated a relatively constant difference of less than 5% in the water vapor continuum in the 425 to 550 wavelengths/cm and 750 to 1200 wavelengths/cm atmospheric 'window' regions, whereas in the 667 wavelengths/cm CO₂ band the difference was 5-10%. T.M.

A74-21467 A case history of remote sensing techniques in a resource inventory process. D. E. Boyer (U.S. Forest Service, Portland, Ore.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 1. Falls Church, Va., American Society of Photogrammetry, 1973, p. 473-480.

Using remote sensing techniques and on-site investigations, a multidiscipline team conducted a physical, biological and visual resource inventory of the Oregon Dunes National Recreation Area. Inventory and interpretative data were developed on the common base of the geomorphic feature and its processes, further stratified by the plant communities. Color infrared photos were utilized in identifying the various plant communities. Their relationships to seasonal ground water fluctuation, wildlife habitat, aesthetic value and stages of dunal stabilization or degradation were established. An integrated report with interpretations was provided to a planning team as the foundation of the Recreation Development Master Plan. (Author)

A74-21478 Gamma - Or translating the Greek. D. S. Ross (International Imaging Systems, Mountain View, Calif.). In: American Society of Photogrammetry, Fall Convention, Lake Buena Vista, Fla., October 2-5, 1973, Proceedings. Part 2. Falls Church, Va., American Society of Photo-

grammetry, 1973, p. 788-802.

'Gamma' is a term frequently mis-used or mis-understood, when applied to the contrast characteristics of images made by remote sensors. Images of ocean phenomena in particular can be affected by important intermediate processes which control gamma in the image reproduced for the user, and consequently his ability to recognize and identify significant phenomena. Spectral scene gamma, recording gamma, reproduction gamma and visual gamma all affect the transfer of information from the scene to the eye of the analyst. The significance of each stage is discussed, and some ways of control are described. (Author)

A74-21906 # Passive microwave radiometry and its potential application to earth-resources surveys. I - Basic physics and technology. E. Ohlsson (SAAB-Scania AB, Linköping, Sweden). *Revue Scientifique et Technique CECLES/CERS*, vol. 5, no. 3-4, 1973, p. 301-335, 10 refs. European Space Research and Technology Centre Contract No. 1411/71.

A74-21907 # Passive microwave radiometry and its potential application to earth-resources surveys. II - Earth-science applications. G. Hoppe (Stockholm, University, Stockholm, Sweden). *Revue Scientifique et Technique CECLES/CERS*, vol. 5, no. 3-4, 1973, p. 337-351, 9 refs.

A74-23315 Remote detection of CO by parametric tunable laser. T. Henningsen, M. Garbuny (Westinghouse Research Laboratories, Pittsburgh, Pa.), and R. L. Byer (Stanford University, Stanford, Calif.). *Applied Physics Letters*, vol. 24, Mar. 1, 1974, p. 242-244, 12 refs.

Resonance absorption of the radiation from a parametrically tuned laser permits the remote detection and density measurement of pollutant gases at large ranges with single-ended systems if topographical features or atmospheric aerosol are used as backscattering means. We have built and demonstrated such a transmitter-receiver system operating at 2.3 microns in the infrared. The presence and amount of a CO sample placed at a range of 107 m against a topographical backscattering target was established by the absorption of rotational lines in the first overtone transition. The results indicate a range limit of the present equipment at 1.5 km and a sensitivity in good agreement with predictions based on measured linewidths and cross sections. (Author)

A74-23411 Nimbus-5 ITPR experiment. W. L. Smith, D. T. Hilleary, J. C. Fischer, H. B. Howell, and H. M. Woolf (NOAA, Suitland, Md.). *Applied Optics*, vol. 13, Mar. 1974, p. 499-506.

The Nimbus-5 infrared temperature profile radiometer (ITPR) experiment was designed to measure upwelling infrared radiation in appropriate spectral intervals and with sufficient geographical resolution for sounding the atmosphere's temperature distribution down to the earth's surface even under partly cloudy sky conditions. A primary scientific goal of the experiment was the specification of the mesoscale features of surface and atmospheric temperature and water vapor that are associated with intense weather systems. In this paper, the ITPR instrument is described, and some initial spacecraft results are given that demonstrate the success of the experiment in achieving its scientific goals. (Author)

A74-23412 Satellite observations of atmospheric water vapor. D. Q. Wark, J. H. Lienesch, and M. P. Weinreb (NOAA, National Environmental Satellite Service, Washington, D.C.). *Applied Optics*, vol. 13, Mar. 1974, p. 507-511, 12 refs.

Observations in the spectral window at 11-12 microns, in the carbon dioxide band at 13.3-13.4 microns, and in the water vapor rotation band at 18.7-18.8 microns have been made by the satellite infrared spectrometer and the vertical temperature profile radiometer

on the Nimbus 4 and NOAA-2 satellites. Combinations of radiances measured by the separate instruments have been used to infer sea-surface temperatures and mesoscale precipitable water in tropical regions. In each spectral interval, atmospheric transmittances for these analyses were constructed from continuous absorption (of unexplained origin), which is dependent upon the square of the partial pressure of water vapor and about the inverse fifth power of temperature, in addition to absorption by resonance lines. (Author)

A74-24438 The physics of electronic and atomic collisions; International Conference, 8th, Belgrade, Yugoslavia, July 16-21, 1973, Invited Lectures and Progress Reports. Conference sponsored by the International Union of Pure and Applied Physics, Union of Yugoslav Societies of Mathematicians, et al. Edited by B. C. Cobic and M. V. Kurepa. Belgrade, Institut za Fiziku, 1973. 705 p.

Inelastic processes in atom collisions at medium energies, metastable negative ions and their formation in atomic collisions, and inner-shell ionization by heavy ions in the MeV energy range are among the topics covered in papers concerned with the physics of electronic and atomic collisions. Other topics covered include correlation effects in electron scattering by positive ions, application of complex angular momentum methods to atomic scattering problems, and nonperturbation methods in high-intensity laser-field interaction.

M.V.E.

A74-25106 Developing geographical remote sensing. K. H. Stone (Georgia, University, Athens, Ga.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 1-13. 46 refs.

The relationship between geographic research and remote sensing is examined as it has progressed from an initial concern with conventional aerial photographs to more recent developments in the nonphotographic portion of the electromagnetic spectrum. Possible future directions which geographical remote sensing may take are also reviewed.

M.V.E.

A74-25109 Remote sensing of natural resources. R. D. Rudd (Denver, University, Denver, Colo.). In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 83-103. 39 refs.

Remote sensing research in the lithosphere, atmosphere, hydrosphere, and biosphere is reviewed. Remote sensing is shown to represent a data source for inventorying, monitoring, and gaining new insights into the complexity of the natural environment in terms of the ecosystems that define at various scales the surface and subsurface character of the earth.

M.V.E.

A74-25387 * Opportunities for space surveys of moisture anomalies. F. R. Krause and L. D. Frederick (NASA, Marshall Space Flight Center, Huntsville, Ala.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 1-38. 31 refs.

Review of a combination of infrared scanning, unsupervised spectroscopic classification, change detection, and perturbation spectroscopy for monitoring anomalous moisture exchange from space. Infrared sensors have been developed which can monitor the solar reflectance from droplet distributions in vegetation and clouds, the absorption of thermal radiation by water vapor, and the microwave attenuation by atmospheric water. Unsupervised spectroscopic classification techniques are emerging which have the potential to subdivide strip maps from infrared scanners into different moisture targets. Intersecting and parallel spacecraft orbits provide opportunities to study the change of recognized targets between two scans and to recognize anomalous moisture exchange

from those changes which significantly exceed the statistical uncertainty of the spectroscopic target signature. The new concept of perturbation spectroscopy shows a potential to quantitatively determine the change of integrated water vapor pressure with a minimum of 'atmospheric truth' and with low spectroscopic resolution that is typical of simple interference filters.

A.B.K.

A74-25400 Remotely piloted vehicles as remote sensing platforms. J. A. Young (USAF, Aero Propulsion Laboratory and Materials Laboratory, Wright-Patterson AFB, Ohio). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2.

Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 269-280. 17 refs.

Technology advances have made possible a large number of useful and economical remotely piloted vehicles (RPV). The operation of several RPV's is described, and their possible use in remote sensing in the atmospheric and earth resources sciences is discussed. One advantage they may have over remote sensing satellites is that they can obtain greater data density and higher resolution. There are high, low, and intermediate altitude capability needs, various speed and range requirements, a number of structural demands, and a spectrum of payload requirements. Cost advantages are discussed in terms of the coupling of similar needs and vehicle requirements.

P.T.H.

A74-25410 On the optimum choice of spectral intervals for remote sensing of environment from space. K. Ia. Kondrat'ev, O. B. Vasil'ev (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR), and G. A. Ivanian. In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 417-434. 10 refs.

A technique is described for the determination of the most informative and contrastive spectral intervals to be recommended in the design of multichannel spectral and photographic apparatus for the survey of different earth formations. Entropy for different natural formations is calculated based on Krinov's (1947) classification, and contrasts for the pair combinations of eleven types of natural formations are computed. Based on these calculations in the wavelength range of 0.4 to 1.1 microns, the following spectral intervals are recommended for space observations: 0.54-0.56, 0.66-0.69, and 0.78-0.82 microns. The influence of the atmosphere on natural formation spectra as observed from space is discussed, and it is pointed out that the choice of spectral intervals for the satellite ERTS-I was not optimal probably because the atmospheric influence was neglected.

P.T.H.

A74-25414 * Development and application of AAFE two-frequency composite microwave radiometer-scatterometer. D. B. Clemson, J. H. Moore, and K. Tomiyasu (GE Valley Forge Space Center, Philadelphia, Pa.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 491-502. Contract No. NAS1-10161.

A74-25418 Atmospheric effects in remote sensing. R. E. Turner (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 549-583. 6 refs.

A radiative-transfer model is presented that is especially adapted to hazy atmospheres for the study of variations in the spectral

radiance arising from target materials considered in remote sensing operations. The model is now being used to define correction functions which can be employed to modify actual scanner data and hence remove variations in the data due to the atmosphere. The potentialities and limitations of the model are discussed. M.V.E.

A74-25913 An airborne gamma ray spectrometer and its application in nuclear power plant site surveys. G. E. Fryer (Utility Data Corp., Rice University, Houston, Tex.) and J. A. S. Adams (Utility Data Corp., Houston, Tex.). (*IEEE, NASA, and AEC, Nuclear Science Symposium, 20th, San Francisco, Calif., Nov. 14-16, 1973.*) *IEEE Transactions on Nuclear Science*, vol. NS-21, Feb. 1974, p. 572-584. 15 refs. Research supported by the Robert A. Welch Foundation, Utility Data Corp., and AEC; Grant No. DACA39-69-C-0048. Project THEMIS.

A74-27305 * An S-band radiometer design with high absolute precision. W. N. Hardy (British Columbia, University, Vancouver, Canada), K. W. Gray (Royal Radar Establishment, Malvern, Worcs., England), and A. W. Love (Rockwell International Corp., Space Div., Downey, Calif.). *IEEE Transactions on Microwave Theory and Techniques*, vol. MTT-22, Apr. 1974, p. 382-390. 12 refs. Contracts No. NAS1-10106; No. NAS1-10691.

A radiometer for the remote measurement of sea surface temperature is described. The development of an instrument capable not only of high relative accuracy (i.e., resolution) but also of high absolute precision is considered. The concepts underlying the design of an instrument capable of an absolute accuracy of a few tenths degrees Kelvin in the measurement of brightness temperature at S band are described. The role of the antenna is discussed, and the importance of high ohmic and beam efficiencies is stressed. The hardware itself is fully described, along with an outline concerning the design of a unique cryogenically cooled termination used to calibrate the whole radiometer, including antenna. Finally, some test results are presented that show that the design goals for the instrument have been closely approached. (Author)

A74-27768 Limitations of laser measurements due to the characteristics of the atmosphere (Begrenzungen der Lasermessungen durch Eigenschaften der Atmosphäre). C. Werner (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany). *Laser/Elektro-Optik*, vol. 6, Mar. 1974, p. 13-15. 9 refs. In German.

The sky radiation is one disturbing factor which has to be taken into account when laser measurements in the atmosphere are conducted. The sky radiation makes it impossible to conduct such measurements in the blue and UV spectral ranges during the day. Difficulties caused by horizontal and temporal inhomogeneities of the atmosphere are also considered. Perturbing effects produced by multiple scattering are particularly critical in the case of visibilities of less than 5 km. G.R.

A74-27876 Radiation studies in the atmosphere (Radiatsionnye issledovaniya v atmosfere). Edited by K. Ia. Kondrat'ev and Iu. I. Rabinovich. Leningrad, Gidrometeoizdat (Glavnaia Geofizicheskaya Observatoriia imeni A. I. Voeikova, Trudy, No. 295), 1973. 212 p. In Russian.

Collection of theoretical and experimental studies conducted at the Observatory in the field of atmospheric radiation. The topics include satellite meteorology, radiometric observations of various natural underlying surfaces, radiant flux measurement methods, automation of radiation measurements and of data processing, radiant energy conversion in the atmosphere-earth interface, and atmospheric aerosols and pollutants. Various types of radiation measurement techniques and equipment are covered. V.Z.

A74-28026 * ERTS-1, the spacecraft and its sensors. S. Weiland and S. G. Freden (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Environmental Sciences*, vol. 17, Mar.-Apr. 1974, p. 11-15.

The basic objectives of the ERTS-1 mission are defined as

follows: (1) to determine what data can be acquired from an orbiting satellite on the natural and cultural resources and on the environment; and (2) to develop and demonstrate the combination of data-acquisition procedures and interpretative techniques which can make this new knowledge available for use in the many facets of man's life. A general description of the satellite's observatory system and its sensors is given, including the thermal control subsystem, the power subsystem, the attitude control subsystem, the orbit adjust subsystem, the telemetry and tracking systems, the communications and data handling subsystem, the return beam vidicon subsystem, the multispectral scanner subsystem, the two wideband video tape recorders, and the data collection subsystem. P.T.H.

A74-28101 Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings (Journées d'Optique Spatiale, 4th, Marseille, France, November 6-8, 1973, Proceedings). Conference sponsored by the Centre National d'Etudes Spatiales. Paris, Centre National d'Etudes Spatiales, 1973. 488 p. In French and English.

Spectrophotometric studies of stellar sources in the far ultraviolet using the TD1 satellite, recent advances in the area of holographic gratings, and semiautomatic devices for satellite tracking and laser telemetry are among the topics covered in papers concerned with space optics. Other topics covered include the application of Kalman filtering to the determination of the attitude of spin-stabilized satellites, the development of a star mapping sensor, and a high-performance deuterated TGS alanine-doped pyroelectric detector. M.V.E.

A74-28149 # Optical sensors used in remote detection of natural resources (Capteurs optiques utilisés en télédétection des ressources naturelles). A. Alouges (Groupe pour le Développement de la Télédétection Aérospatiale, Brétigny-sur-Orge, Essonne, France). In: Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings. Paris, Centre National d'Etudes Spatiales, 1973, p. 449-451. In French.

Recommendation of a method of facilitating the interpretation of data obtained by optical sensors regarding objects on the earth's surface. A method of contrast enhancement by mixing images obtained in different spectral bands is proposed to improve the efficiency of image interpretation. Several advantages of the method are noted, as well as a disadvantage that the image obtained is specialized to the needs of a particular user and cannot be used with equal profit by other specialists. A.B.K.

A74-28150 # Multispectral analyzer (Analyseur multispectral). G. Otrio (Centre National d'Etudes Spatiales, Toulouse, France). In: Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings. Paris, Centre National d'Etudes Spatiales, 1973, p. 453-470. In French.

CNES is considering launching an earth observation satellite similar to the ERTS 1 satellite. The purpose of the satellite would be to obtain land use imagery of Europe and the Mediterranean zones in several spectral ranges. It is proposed that the satellite be placed in a heliosynchronous orbit, returning to the same longitude every nine days. A coverage width of 300 km is projected. The properties and relative merits of scanning and TV methods of image recording are discussed, but their ultimate evaluation will rest on studies of image restitution methods. P.T.H.

A74-28151 # Onboard camera project for earth resource studies (Projet de caméra embarquée pour l'étude des ressources terrestres). G. Abraham and F. Desvignes (Société Anonyme d'Etudes et de Réalisations Nucléaires, Limeil-Brévannes, Val-de-Marne, France). In: Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings. Paris,

Centre National d'Etudes Spatiales, 1973, p. 471-490. In French.

The feasibility study of a space borne television camera for earth resources analysis has been done with the support of CNES, in cooperation with Bertin et Cie, Crouzet et Cie, LEP and CERCO. Two basic designs have been selected for their capability to fulfill the mission requirements: spatial resolution, telemetry capacity, weight, volume. These solutions are described, their main characteristics and technological problems are reviewed. (Author)

A74-28152 # Comparison of different systems of remote detection of terrestrial resources (Comparaison de différents systèmes de télédétection de ressources terrestres). M. Detaille, G. Courtes (CNRS, Laboratoire d'Astronomie Spatiale Marseille, France), and M. N. Petitgas (Délégation Ministérielle pour l'Armement, Montrouge, Hauts-de-Seine, France). In: Conference on Space Optics, 4th, Marseille, France, November 6-8, 1973, Proceedings. Paris, Centre National d'Etudes Spatiales, 1973, p. 491-506. In French.

We briefly review and compare the various systems used for the remote detection of terrestrial resources, with particular emphasis on the specifications of the CNES satellite project. Laboratory results obtained with a Chromotron-type apparatus by LAS and L.C.A. are presented, and we raise the possibility of placing such an instrument aboard an earth resources satellite. (Author)

A74-28322 * Sensor performance evaluation of the Skylab multispectral photographic facility. F. J. Corbett (Itek Corp., Lexington, Mass.). In: American Society of Photogrammetry, Annual Meeting, 40th, St. Louis, Mo., March 10-15, 1974, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1974, p. 20-24. Contract No. NAS9-10698.

N74-16093# Aerospace Corp., El Segundo, Calif.
REMOTE SENSING OF ATMOSPHERIC METHANE USING AN ERBIUM/YAG LASER: A FEASIBILITY STUDY
Kenneth O. White and Gerald T. Wade Nov. 1973 26 p refs (DA Proj. 1TO-61102-B-53A)
(AD-769732; ECOM-5517) Avail: NTIS CSCL 07/4

A research program is underway to determine the feasibility of a remote sensing scheme for the detection of methane based on a coincidence between the emission of the erbium/YAG laser and a methane absorption line occurring at 1644.9 nm. Two remote sensing techniques are being considered: the differential absorption transmission method and the differential absorption lidar technique. The research program consists of an experimental part to determine the spectral line parameters, and a theoretical part to determine the performance that could be expected from a remote sensing system. The paper reports results of calculations, using the best available data, made to determine the performance that could be expected with the above two techniques. These results indicate that both techniques are feasible with actual performance determined by the atmospheric visibility conditions and the exact value of the absorption coefficient of the methane absorption line. (Modified author abstract) GRA

N74-16292*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL ENVIRONMENT (CLIMATIC) CRITERIA GUIDELINES FOR USE IN AEROSPACE VEHICLE DEVELOPMENT, 1973 REVISION

Glenn E. Daniels, ed. 5 Jul. 1973 472 p refs Revised (NASA-TM-X-64757) Avail: NTIS HC \$25.75 CSCL 04B

Guidelines are provided on probable climatic extremes and terrestrial environment data applicable to space vehicle and associated equipment design and development. Operational criteria for ground support sites are emphasized.

N74-16308* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC ATTENUATION RELATIVE TO EARTH-VIEWING ORBITAL SENSORS c13

S. Clark Brown, and Robert R. Jayde, Jr. In: *Terrest. Environ. (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Develop.* 1973 Rev. 5 Jul. 1973 21 p refs

CSCL 04A

Earth viewing space missions offer exciting new possibilities in several earth resources disciplines - geography, hydrology, agriculture, geology, and oceanography, to name a few. A most useful tool in planning experiments and applying space technology to earth observation is a statistical description of atmospheric parameters. Four dimensional atmospheric models and a world wide cloud model are used to produce atmospheric attenuation models to predict degradation effects for all classes of sensors for application to earth sensing experiments from spaceborne platforms. To insure maximum utility and application of these products, the development of an interaction model of microwave energy and atmospheric variables provides a complete description of the effects of atmospheric moisture upon microwaves.

Author

N74-16689# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE NATURAL MEDIUM AND SPACE

Kirill Yakovlevich Kondratyev 10 Oct. 1973 20 p ref Transl. into ENGLISH Kirill Yakovlevich (USSR), no. 5, 1972 p 169-183

(FTD Proj. T74-01-42)

(AD-768459; FTD-MT-24-704-73) Avail: NTIS CSCL 08/6

The article reviews use of scientific satellites on the remote sensing of earth events from space. GRA

N74-16900# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).

SIDE-LOOKING RADAR SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH-RESOURCES SURVEYS. BASIC PHYSICS AND TECHNOLOGY

R. A. Deane Paris ESRO Apr. 1973 131 p refs (Contract ESTEC-1537/71)

(ESRO-CR-136) Avail: NTIS HC \$9.75

The basic physics and technology of real and synthetic aperture side-looking radar systems are described with particular emphasis on their application to earth resources surveys. The installation and operation of the radar in aircraft and satellites is considered for mapping both static terrain and moving vehicles. A brief introduction is included on atmospheric influences and terrain reflections at microwave frequencies. ESRO

N74-17049 Department of Energy, Mines and Resources, Ottawa (Ontario).

RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 14: REMOTE SENSING DEVICES

Dennis White, ed. and B. H. Nodwell 1971 133 p refs

(M75-2/14) Copyright. Avail: Issuing Activity

Conclusions and recommendations regarding the remote-sensing devices available or under development are presented as a comprehensive compendium of all the significant physical characteristics of remote-sensing devices, together with sketches illustrating their method of operation. This information will be helpful in selecting the most appropriate available system for use and will also guide sensor development into those areas not covered by existing systems. The tables of available equipment are arranged in such a way that comparison of characteristics between sensors is easily made. A brief introduction to each class of sensors is provided, together with a brief description of each system. Author

N74-17063*# Environmental Research and Technology, Inc., Lexington, Mass.

EXPERIMENTAL EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENTS USING THE EREP OF SKYLAB Quarterly Progress Report, Nov. 1973 - Jan. 1974

08 INSTRUMENTATION AND SENSORS

David T. Chang, Principal Investigator 9 Feb. 1974 8 p refs
 EREP
 (Contract NAS9-13343)
 (E74-10269; NASA-CR-136655; QPR-3) Avail: NTIS
 HC \$3.00 CSCL 04A

N74-17095*# Boeing Co., Kent, Wash.

**[MICRODENSITOMETER SCANNING OF SL3 S190 IM-
 AGERY AND ACCOMPANYING STEP WEDGES]** Monthly
 Report, Jan. 1974

David L. Tingey, Principal Investigator Jan. 1974 2 p EREP
 (Contract NAS9-13303)
 (E74-10307; NASA-CR-136789) Avail: NTIS HC \$4.00 CSCL
 14B

N74-17172# Saab-Scania, Linköping (Sweden).

**PASSIVE MICROWAVE RADIOMETRY AND ITS POTENTIAL
 APPLICATIONS TO EARTH RESOURCES SURVEYS. BASIC
 PHYSICS**

S. Axelsson and O. Edvardsson Paris ESRO Feb. 1973
 107 p refs

(Contract ESTEC-1411/71)

(ESRO-CR-71) Avail: NTIS HC \$8.50

Since objects with a temperature above absolute zero emit electromagnetic energy, sensing and analysis of this radiation make it possible to obtain information about objects at a distance. In practice, there are various sources of errors that affect measurement accuracy such as attenuation by the atmosphere and reflection of energy from other sources (sun, radar, etc). Various ways of avoiding or minimizing these errors are discussed together with errors arising from the limitations of the sensor. Finally, the connection between user requirements and system parameters is discussed. ESRO

N74-17173# Research Inst. of National Defence, Stockholm (Sweden).

**PASSIVE MICROWAVE RADIOMETRY AND ITS POTENTIAL
 APPLICATIONS TO EARTH RESOURCES SURVEYS.
 MICROWAVE EMISSIONS FOR NATURAL MATERIALS**

Torleiv Orhaug Paris ESRO May 1973 79 p refs
 (Contract ESTEC-1411/71)

(ESRO-CR-74) Avail: NTIS HC \$7.00

The theory of generation of thermal microwave noise from solid and gaseous objects is summarized. The influence of various material properties is discussed in detail, particularly for a conducting glossy object, where the Fresnel coefficient can be used for predicting brightness properties. The effect and characteristics of atmospheric noise are discussed, and examples of microwave observations of atmospheric noise are given. The scattering properties of an object having a rough surface are discussed, emphasis being laid on the limitations of theoretical analysis. The generation of noise from rough surfaces is also treated. The polarization effect to be expected from glossy and rough surfaces is considered and the influence of atmospheric noise discussed. The effects of thermal noise caused by sub surface inhomogeneities and by time-varying heating are discussed. Finally, a summary of present programs and present knowledge in this field is given, together with recommendations for future work. ESRO

N74-18001*# Kansas Univ. Center for Research, Inc., Lawrence. Atmospheric Science Lab.

**DETECTION OF MOISTURE AND MOISTURE RELATED
 PHENOMENA FROM SKYLAB** Monthly Progress Report,
 Feb. 1974

Joe R. Eagleman, Ernest C. Pogge, Richard K. Moore, Principal
 Investigators. Norman Hardy, Wen Lin, and Larry League Feb.
 1974 11 p EREP

(Contract NAS9-13273)

(E74-10325; NASA-CR-136820) Avail: NTIS HC \$4.00 CSCL
 08M

The author has identified the following significant results.

Data from five Skylab passes were combined to give a composite relationship between the S194 antennae temperature and soil moisture content in the surface to one inch layer. The five data sets were comparable and resulted in a correlation coefficient of -0.97. The regression equation was used to predict soil moisture content across the United States for one particular pass on August 5, 1973.

N74-18039*# National Aeronautics and Space Administration. Mississippi Test Facility, Bay Saint Louis.

**CORRECTING AIRBORNE SCANNING INFRARED RA-
 DIOMETER MEASUREMENTS FOR ATMOSPHERIC EF-
 FECTS**

Robert D. Boudreau Sep. 1972 43 p refs

(NASA-TM-X-69940; ERL-029) Avail: NTIS HC \$5.25 CSCL
 08J

Two techniques were developed for determining atmospheric corrections from observations made by a scanning radiometer. Both techniques depend on knowing the radiometer's limb function. The limb function for an RS-18 scanning radiometer is derived from calculations made with a radiation model and used to demonstrate the techniques. One technique requires observations made over an isothermal water surface within the area being remotely sensed. The other technique does not depend on an isothermal water surface but requires a boat measurement of radiometric sea surface temperature within the area being remotely sensed. The radiation model used to derive the limb function does not account for the effects of atmospheric particulates on the correction. It is hypothesized that the effect of particulates on the limb function derived in this study is negligible, and therefore the technique essentially obtains the total correction. The techniques developed can be used over land provided that a section of isothermal land exists within the experiment area or that a radiometric measurement of surface temperature is made at the surface. Author

N74-18271 Joint Publications Research Service, Arlington, Va.
**THE SYSTEM OF OBSERVATIONS FOR THE FIRST
 WORLDWIDE GARP EXPERIMENT** c13

V. P. Meleshko *In its Meteorology and Hydrology*, No. 11,
 1973 (JPRS-61249) 15 Feb. 1974 p 158-169 refs Transl.
 into ENGLISH from Meteorol. Gidrol. (Moscow), no. 11, 1973
 p 108-114

The organization, general description, and composition of the system of observations that has been suggested for the first worldwide GARP (Global Atmospheric Research Program) experiment in 1977 are presented. The subjects discussed are: (1) observation equipment required, (2) numerical experiments to investigate the properties of the observation means, (3) the recommended observation system, and (4) participation of various countries in the experiment. Author

N74-19059# General Electric Co., West Lynn, Mass.

**SINGLE FLIGHT STEREO RADAR USING A MECHANICALLY
 SLEWED ARRAY AND AN ELECTRICALLY SQUINTED
 ARRAY**

Gordon E. Carlson and George L. Bair Nov. 1973 158 p refs
 (Contract N00014-69-A-0141-0008; NR Proj. 387-069)
 (AD 771434, CSR-73-b) Avail: NTIS CSCL 08/2

An improved single flight technique for obtaining stereo radar image pairs is described and its feasibility is analyzed. This improved technique uses a unique combination of two different antenna beam characteristics which permits the illumination of a terrain point from nearly the same aircraft position while providing image geometry differences sufficient to provide useful parallax data. The analysis encompasses theoretical performance analyses, tradeoff analyses and, error analyses. The error analyses are also used to select a best set of reconstruction equations for computation of the terrain point orthographic position and height from image position measurements made with a stereocomparator. Comparisons are made of the theoretical and error performance for the improved single flight technique with respect to a previously implemented two-flight technique and a previously proposed single flight technique. (Modified author abstract)

GRA

N74-19095* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLIGHT TEST OF A PRESSURIZATION SYSTEM USED TO MEASURE MINOR ATMOSPHERIC CONSTITUENTS FROM AN AIRCRAFT

Gregory M. Reck, Daniel Briehl, and Porter J. Perkins Washington Mar. 1974. 26 p refs
(NASA-TN-D-7576; E-7701) Avail: NTIS HC \$3.25 CSCL 14B

A flight evaluation of an ambient air sample pressurization system was conducted at altitudes between 6 and 12 km. The system regulated the sample pressure to 10.15 ± 0.1 N/sq n and provided sample flow to three gas analysis instruments included in the system. Ozone concentrations measured by two instruments employing different techniques varied from about 30 parts per billion by volume (ppbv) to over 350 ppbv, and the two ozone monitors agreed to within 20 ppbv. A carbon dioxide analyzer indicated modifications required for future installations. Author

N74-19934 Oklahoma Univ., Norman.

UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION Ph.D. Thesis

Robert Rhea Jayroe, Jr. 1973 123 p
Avail: Univ. Microfilms Order No. 73-23943

The development of a computer program for extracting features from remotely sensed data presented in digital image form is presented. This computer program requires no human supervision or judgement and operates unassisted on the raw digital data. The presentation of this work includes a condensed general background on remote sensing of earth features, and a short synopsis on some of the most commonly used types of feature extraction techniques. A presentation of results obtained from the unsupervised feature extraction computer program along with description and listing of the computer program is also presented. Dissert. Abstr.

N74-19982* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

USE OF VISIBLE, NEAR-INFRARED, AND THERMAL INFRARED REMOTE SENSING TO STUDY SOIL MOISTURE

Maxwell B. Blanchard, Ronald Greeley (Santa Clara Univ., Calif.), and Robert Goettelman (LFF Corp., Calif.) Apr. 1974 9 p refs
(NASA-TM-X-62343) Avail: NTIS HC \$4.00 CSCL 08M

Two methods are described which are used to estimate soil moisture remotely using the 0.4- to 14.0 micron wavelength region: (1) measurement of spectral reflectance, and (2) measurement of soil temperature. The reflectance method is based on observations which show that directional reflectance decreases as soil moisture increases for a given material. The soil temperature method is based on observations which show that differences between daytime and nighttime soil temperatures decrease as moisture content increases for a given material. In some circumstances, separate reflectance or temperature measurements yield ambiguous data, in which case these two methods may be combined to obtain a valid soil moisture determination. In this combined approach, reflectance is used to estimate low moisture levels; and thermal inertia (or thermal diffusivity) is used to estimate higher levels. The reflectance method appears promising for surface estimates of soil moisture, whereas the temperature method appears promising for estimates of near-subsurface (0 to 10 cm). Author

N74-20536* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WIDE AREA COVERAGE RADAR IMAGING SATELLITE FOR EARTH APPLICATIONS

Grady H. Stevens and James R. Ramler Feb. 1974 111 p refs
(NASA-TM-X-71515; E-7903) Avail: NTIS HC \$8.75 CSCL 22B

A preliminary study was made of a radar imaging satellite for earth applications. A side-looking synthetic-aperture radar was considered and the feasibility of obtaining a wide area coverage to reduce the time required to image a given area was investigated. Two basic approaches were examined: low altitude sun-synchronous orbits using a multibeam/multifrequency radar system and equatorial orbits up to near-synchronous altitude using a single beam system. Surveillance and mapping of ice on the Great Lakes was used as a typical application to focus the study effort. Author

N74-20951* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REPORT OF OPTICAL GROUND TRUTH MEASUREMENTS FOR 5 AUGUST 1973, TEST SITE NUMBER 548532, IN SUPPORT OF THE SKYLAB MULTISPECTRAL SCANNER Special Report, Mar. 1973 - Jun. 1974

Frederick J. Thomson, Principal Investigator, D. Zuk, and G. Suits Jan. 1974 107 p EREP
(Contract NAS9-13272)
(E74-10423; NASA-CR-137282; ERIM-101700-10-X) Avail: NTIS HC \$8.50 CSCL 08B

N74-20959* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-31 Dec. 1973

R. K. Moore, Principal Investigator and Arun Sobti 7 Mar. 1974 2 p ref EREP
(Contract NAS9-13331)
(E74-10432; NASA-CR-137379) Avail: NTIS HC \$4.00 CSCL 14B

N74-20960* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-30 Nov. 1973

R. K. Moore, Principal Investigator and Arun Sobti 7 Mar. 1974 2 p ref EREP
(Contract NAS9-13331)
(E74-10433; NASA-CR-137380) Avail: NTIS HC \$4.00 CSCL 14B

N74-20961* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-28 Feb. 1974

R. K. Moore, Principal Investigator and Arun Sobti 8 Mar. 1974 2 p ref EREP
(Contract NAS9-13331)
(E74-10434; NASA-CR-137381) Avail: NTIS HC \$4.00 CSCL 14B

N74-20962* Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

[MICROWAVE RADIOMETER-SCATTEROMETER MEASUREMENTS] Monthly Progress Report, 1-31 Jan. 1974

R. K. Moore, Principal Investigator and Arun Sobti 8 Mar. 1974 2 p EREP
(Contract NAS9-13331)
(E74-10435; NASA-CR-137382) Avail: NTIS HC \$4.00 CSCL 14B

N74-20965* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AIRBORNE MULTISPECTRAL DATA COLLECTION Final Report, 28 Feb. 1969 - 31 Dec. 1973
 Philip G. Hasell, Jr. Jan. 1974 57 p refs
 (Contract NAS9-9304)
 (NASA-CR-137418; ERIM-190901-1-F) Avail: NTIS HC \$6.00 CSCL 08B

Multispectral mapping accomplishments using the M7 airborne scanner are summarized. The M7 system is described and overall results of specific data collection flight operations since June 1971 are reviewed. A major advantage of the M7 system is that all spectral bands of the scanner are in common spatial registration, whereas in the M5 they were not. Author

N74-20986# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 1: SUMMARY REPORT
 J. B. Farrow, comp. Dec. 1973 94 p refs Sponsored by ESRO 4 Vol.
 (HSDP-TP-7400-Vol-1 ESRO-CR(P)-353) Avail: NTIS HC \$7.75

Information is provided on the basic physics of atmospheric processes which influence remote sensing measurements. These processes include: gaseous absorption and emission; particle scattering, absorption and emission; and refraction and turbulence. Standard atmospheric conditions and variations which can occur in the mean state are described. The influence of the atmosphere on incident and reflected solar radiation and on emitted scene radiation are described with reference to the major types of sensor. Various possible means of correcting atmospherically degraded data are reviewed. Author (ESRO)

N74-20987# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 2: ULTRAVIOLET, VISIBLE AND INFRARED REGIONS
 Dec. 1973 170 p refs Sponsored by ESRO 4 Vol.
 (HSDP-TP-7400-Vol-2; ESRO-CR(P)-354) Avail: NTIS HC \$11.50

Atmospheric influences on remote sensing are reviewed for wavelengths from the ultraviolet to the infrared region. The earth's atmosphere is described, and the important physical processes occurring within it are explained. These processes include: gaseous absorption and emission; particle scattering, absorption, and emission; and refraction and turbulence. The influences of these atmospheric processes on passive and active sensors mounted on various platforms are reviewed. Correction techniques, to restore atmospherically degraded data to an error-free form, are examined. ESRO

N74-20988# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
THE INFLUENCE OF THE ATMOSPHERE ON REMOTE SENSING MEASUREMENTS. VOLUME 3: MICROWAVE AND RADIO WAVELENGTHS
 Dec. 1973 132 p refs Sponsored by ESRO 4 Vol.
 (HSDP-TP-7400-Vol-3; ESRO-CR(P)-355) Avail: NTIS HC \$9.75

Atmospheric influences on remote sensing are reviewed for wavelengths in the microwave and radio region. The earth's atmosphere is described and the important physical processes occurring under it are explained. These processes include: gaseous absorption and emission; particle scattering, absorption, and emission; and refraction and turbulence. The influence of these atmospheric processes and passive and active sensors mounted on platforms are reviewed. Correction techniques, to restore atmospherically degraded data to error free, are examined. ESRO

N74-21000# Missouri Univ., Rolla. Dept. of Electrical Engineering.
COMPARATIVE EVALUATION OF AN IMPROVED SINGLE FLIGHT STEREO RADAR TECHNIQUE Final Technical Report
 Gordon E. Carlson and George L. Bair Feb. 1974 98 p refs
 (Contract N00014-69-A-0141-0008; NR Proj. 387-069)
 (AD-774762; CSR-74-1) Avail: NTIS CSCL 08/2

An improved single flight technique for obtaining stereo radar image pairs is evaluated and compared with a previously proposed single flight technique and a previously implemented two flight technique. The prime concern of the report is a performance evaluation and comparison of the techniques with the use of computer generated pseudo-radar images. The terrain modelling and computer simulation methods used are described as well as stereocomparator measurement results. Improved stereoviewability was observed for the improved single flight technique as compared with the previously proposed single flight technique and both were better than the previously implemented two flight technique. The improved stereoviewability of the single flight images resulted in terrain flight measuring errors which are only 59% as large as those for the two flight technique. (Modified author abstract) GRA

N74-21022# Joint Publications Research Service, Arlington, Va.
MAGNETOMETERS
 2 Apr. 1974 36 p refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 29 p
 (JPRS-61636) Avail: NTIS HC \$5.00

Various types and designs of magnetometers are described, including rubidium, towed, quantum, and T-airborne magnetometers. The component reliability and accuracy are also considered.

N74-21028 Joint Publications Research Service, Arlington, Va.
DETERMINING THE ACCURACY IN REGISTRY BY HIGHLY SENSITIVE AIRBORNE MAGNETOMETERS
 L. N. Kotlyarevskiy *In its* Magnetometers (JPRS-61636) 2 Apr. 1974 p 30-33 refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 44, 1970 p 173-175

The accuracy of an airborne magnetometer survey was determined from computational results of the mean square difference between the Delta T curves. These curves were registered on the same flight path on different days or with different instruments. Another method for determining magnetometer accuracy was proposed, comparing the cross sections of reflections. J.A.M.

N74-21035# Bochum Observatory (West Germany).
AERIAL PHOTOGRAPHY, REMOTE SENSING, SATELLITE PHOTOGRAPHY [LUFTBILD, FERNERKUNDUNG, SATELLITENAUFNAHME]
 Anne-Marie Martin, comp. 1973 15 p refs In GERMAN
 Presented at the DGPH and DFG Working Group meetings on "Photointerpretation" and "Fernerkundung", Hannover, 25-26 Oct. 1973
 Avail: NTIS HC \$4.00

Aerial photography, remote sensing, and satellite photography are discussed. Developments in aerial photography, mapping, and automatic image evaluation are indicated. Factors influencing remote sensing data evaluation are mentioned. Satellite photography is discussed, particularly in relation to Earth Resources Technology Satellites projects. Education courses and documentation systems are mentioned. ESRO

N74-21235* Colorado State Univ., Fort Collins.
FEASIBILITY OF REMOTE EVAPORATION AND PRECIPITATION ESTIMATES
 Willz Z. Sadeh Apr. 1974 32 p refs
 (Contract NAS8-28590)
 (NASA-CR-129023) Avail: NTIS HC \$4.75 CSCL 04B

Remote sensing by means of stereo images obtained from flown cameras and scanners provides the potential to monitor the dynamics of pollutant mixing over large areas. Moreover, stereo technology may permit monitoring of pollutant concentration and mixing with sufficient detail to ascertain the structure

of a polluted air mass. Consequently, stereo remote systems can be employed to supply data to set forth adequate regional standards on air quality. A method of remote sensing using stereo images is described. Preliminary results concerning the planar extent of a plume based on comparison with ground measurements by an alternate method, e.g., remote hot-wire anemometer technique, are supporting the feasibility of using stereo remote sensing systems. Author

09

GENERAL

Includes economic analysis.

A74-20469 Establishment of an international earth resources satellite system (Errichtung eines internationalen Erderkundungssatellitensystems). W. von Kries. *Zeitschrift für Luftrecht und Weltraumrechtsfragen*, vol. 23, Jan. 1, 1974, p. 51-59. 51 refs. In German.

It is pointed out that the systematic exploration of earth from space has begun only recently on July 23, 1972, with the launching of the U.S. ERTS-1. The current ERTS program is undertaken by NASA. The ERTS system was originally only designed for internal U.S. objectives. However, NASA internationalized the program by inviting all scientists of the earth to participate in it. The present ERTS program conducted by NASA has experimental characteristics. Developments for an earth resources satellite program conducted by another organization on a more international basis will presumably take place after the present program has provided the technological basis for such developments. G.R.

A74-20470 Legal problems concerning remote-sensing surveys of earth resources by satellites (Rechtsprobleme der Fernerkundung von Bodenschätzen durch Satelliten). M. A. Dausen. *Zeitschrift für Luftrecht und Weltraumrechtsfragen*, vol. 23, Jan. 1, 1974, p. 60-68. 46 refs. In German.

Scientific and technological aspects involved in the satellite surveys are discussed together with work performed by the United Nations in connection with the utilization of remote sensing methods. Questions regarding the legal status of the satellite surveys according to international law are examined, taking into account an analysis conducted by Galloway (1973), the interpretation of the term 'peaceful,' and the principle of the permanent sovereignty of a state over its natural resources. The desirability of the establishment of an international agency for satellite remote-sensing surveys is also discussed. G.R.

A74-20533 International congress of space benefits; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., June 19, 20, 1973. Meeting sponsored by the American Astronautical Society. Edited by F. S. Johnson (Texas, University, Dallas, Tex.). Tarzana, Calif., American Astronautical Society (Advances in the Astronautical Sciences. Volume 30), 1974. 514 p. Members, \$18.75; nonmembers, \$25.

Topics discussed include the Space Shuttle program, the use of satellites for educational TV, the role of Great Britain in the development of space communications and navigation systems, a proposed Canadian telecommunication service via satellite, the compatibility of the two types of earth resources information systems and problems of interfacing such systems to the user community, the use of remote sensor systems in resource and land use surveys, and the use of vertical temperature profile radiometer data from the NOAA-2 satellite for numerical forecasts of weather. A.B.K.

A74-20538 * Analysis research for earth resource information systems - Where do we stand. D. A. Landgrebe (Purdue University, West Lafayette, Ind.). In: International congress of space

benefits; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., June 19, 20, 1973. Tarzana, Calif., American Astronautical Society, 1974, p. 255-278. 12 refs. Grant No. NGL-15-005-112.

Discussion of the state of the technology of earth resources information systems relative to future operational implementation. The importance of recognizing the difference between systems with image orientation and systems with numerical orientation is illustrated in an example concerning the effect of noise on multiband multispectral data obtained in an agricultural experiment. It is suggested that the data system hardware portion of the total earth resources information system be designed in terms of a numerical orientation; it is argued, however, that this choice is entirely compatible with image-oriented analysis tasks. Some aspects of interfacing such an advanced technology with an operational user community in such a way as to accommodate the user's need for flexibility and yet provide the services needed on a cost-effective basis are discussed. A.B.K.

A74-20539 Contributions of the EROS program to the Department of the Interior's resources and management responsibilities. W. A. Fischer (U.S. Geological Survey, Washington, D.C.). In: International congress of space benefits; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., June 19, 20, 1973. Tarzana, Calif., American Astronautical Society, 1974, p. 409-420. 16 refs.

Brief review of the role of the EROS (Earth Resources Observation Systems) program in evaluating the use of remote sensor systems to obtain resources and environmental data for land use decisions. The four principal objectives of the EROS program are cited, and its sponsoring of research in the development of a variety of new cartographic products derived from high-altitude aircraft and spacecraft data is noted. An evaluation is made of the quality of ERTS satellite data and their usefulness in mapping unexplored regions, compiling land use maps, mapping geological structures in connection with minerals and petroleum exploration, and mapping wave in the plane of incidence, which is perpendicular to a dc magnetic field) in InSb near room temperature. When the semiconductor slab is covered with a thin dielectric layer acting as a matching transformer, improved performance is predicted and observed at 337 microns, and very efficient isolator performance is predicted for 118 microns. Physical arguments are presented to explain the non-reciprocal phenomenon and lead to better device design. (Author)

A74-20835 # Space applications - What the people want. J. W. Symington (U.S. House of Representatives, Washington, D.C.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 10th, Washington, D.C., Jan. 28-30, 1974, Paper 74-248*. 10 p. Members, \$1.50; nonmembers, \$2.00.

The benefits which have accrued to our citizens from the advent of technological (in particular, meteorological and communications) satellites are noted, and the contributions of the Space Applications Program are reviewed. The necessity of continuing government-supported R & D effort in the field of technological satellites, and especially of advancing and accelerating the ERTS program, is emphasized. V.P.

A74-22189 # Earth resources satellites - The interest for European industry. J. Plevin (ESRO, Space Applications Div., Neuilly-sur-Seine, Hauts-de-Seine, France). (*European Space Symposium on International Collaboration in Space, 13th, London, England, June 25-27, 1973*.) *British Interplanetary Society, Journal*, vol. 27, Mar. 1974, p. 161-172. 11 refs.

In order for the European earth scientist community to take large-scale advantage of earth satellites in geophysical studies, it will be necessary to overcome many problems. In Europe, the more sophisticated remote sensing systems are unavailable, except to military programs. Industry would have to provide vast software

support, which would involve risky capital investments unless a program were conducted at a government, and most likely, international level. As earth scientists would generally not be familiar with the operation of the remote sensing equipment, interdisciplinary cooperation would have to be fostered. A preparatory program centered around aircraft equipped with remote sensing instruments is suggested.
P.T.H.

A74-24961 Astronautical research 1972; Proceedings of the Twenty-third Congress, Vienna, Austria, October 8-15, 1972. Congress sponsored by the International Astronautical Federation. Edited by L. G. Napolitano, P. Contensou, and W. F. Hilton. Dordrecht, D. Reidel Publishing Co., 1973. 366 p. \$39.45.

Recent advances in space science and technology are described by papers dealing with basic problems in astrodynamics and bioastronautics, the engineering and management aspects of space technology, space applications in a variety of disciplines, and scientific activities conducted by students at universities. Some specific topics include the theory of spacecraft motion in a noncentral gravitational field, spacecraft wash-water recovery, contamination of the spacecraft atmosphere by carbon monoxide, performance evaluation of dual (mixed) propellant vehicles, spacecraft stability to pogo vibrations, developments in remote sensing applications, materials processing in a zero-gravity environment, use of the finite element method for aerospace structures, and Mercury orbit trajectories.

T.M.

A74-25118 Selected bibliography of remote sensing research. In: Remote sensing: Techniques for environmental analysis. Santa Barbara, Calif., Hamilton Publishing Co., 1974, p. 311-328. 221 refs.

A74-25386 Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Conference sponsored by the University of Tennessee. Edited by F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973. 1279 p. \$30.

Recent progress in the application of remote sensing techniques to the observation and analysis of earth resources is reflected in papers dealing with theoretical models of relevant physical processes, details of imaging and transmission techniques, and results of particular observational programs. Some specific topics include use of TV images from space for composition of regional tectonic maps, remote measurement of pollution levels, detection of urban blight, interpretation of satellite photography with and without support aerial photography, monitoring of agricultural variables, measurement of salinity in an estuarine environment, selection of optimal spectral intervals for specific environmental variables, near-nadir radar cross section measurements of the ocean surface, and adaptive procedures in multispectral pattern recognition.

Individual items are announced in this issue.

T.M.

A74-25388 User needs and applications for remote sensing. W. T. Talbot (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 39-56.

This paper describes an attempt to improve upon existing techniques and capabilities for assessing critical national problems. It is a beginning, among others, of an attempt to develop a logical approach and methodology for breaking down problems into definitive organizational roles for resolution, and for translating assigned charter responsibilities into investigation requirements and

information needs for remote sensing system applications. By integrating each critical national problem with the assigned character responsibilities and objectives of various Government agencies, key problem effects on agency activity can be defined and, from these, basic problem investigation issues and questions for formulating information requirements.
(Author)

A74-25404 Remote observation of earth resources - Economic data problems. W. Gensurowsky (U.S. Department of Agriculture, Economic Research Service, Washington, D.C.). In: Remote sensing of earth resources; Proceedings of the Second Conference on Earth Resources Observation and Information Analysis System, Tullahoma, Tenn., March 26-28, 1973. Volume 2. Tullahoma, Tenn., F. Shahrokhi, University of Tennessee, 1973, p. 313-325. 5 refs.

This manuscript concerns itself with quantitative scientific problems of remote data selection, model construction, and estimation for hypothesis testing. The basic problems are pointed out and solutions presented. Data collected across large regions of the world contain a wealth of new information on behavioral, technical, and cultural phenomena. Existing methods of scientific measurement usually do not conform to the systematic and random components characteristic of data and models based upon remote observations. Some new approaches are developed and present techniques modified. Because of the technical nature of the problems, the diversity of the audience, and the esoteric character of research, a mathematical treatise is avoided.
(Author)

A74-26718 The origins and international economics of space exploration. B. Lovell (Manchester, Victoria University, Jodrell Bank, Ches., England). New York, Halsted Press, 1973. 110 p. 82 refs. \$4.50.

The concept of the rocket and its development as a ballistic weapon is reviewed, followed by discussion of the Soviet ballistic rocket and the first Sputnik. The scientific origins of space exploration are considered. Attention is given to the number of space launchings and their global costs, and the military component of the space launchings. Aspects of communications, science in space, meteorology, navigation, and geodesy and mapping are treated. Earth resources are discussed, with attention to agriculture, forestry, water, and fish harvest.
F.R.L.

A74-28505 # The application of orbital remote sensing. S. L. Entres (Royal Aircraft Establishment, Farnborough, Hants., England). (*British Interplanetary Society, Symposium on Earth Observation Satellites, University College, London, England, Apr. 10-12, 1973.*) *British Interplanetary Society, Journal*, vol. 27, May 1974, p. 349-358.

The recent advent, vast potentialities, and present status of orbital remote sensing are discussed, along with the major prerequisites to significant further advances. Special attention is given to European research priorities in orbital remote sensing applications.

M.V.E.

A74-28506 # Rocket photography for earth resources surveys. R. A. G. Savigear, J. R. Hardy, C. W. Mitchell, R. B. Ridgway, and A. J. Parsons (Reading, University, Reading, Berks., England). (*British Interplanetary Society, Symposium on Earth Observation Satellites, University College, London, England, Apr. 10-12, 1973.*) *British Interplanetary Society, Journal*, vol. 27, May 1974, p. 359-372.

The evaluation of the imagery obtained in an experiment of rocket-borne earth-resource photography, performed at Woomera, Australia, in March 1972, is shown to indicate that a rocket can provide a successful platform for high altitude sensing of the earth's resources. Though a full comparison of costs is as yet to be made, it appears that, in large relatively unknown areas where basic terrain resources are unmapped, or where a continuing crop survey is to be made, a rocket-borne survey may produce the needed information at a price competing well with that of aircraft-borne photography.

M.V.E.

N74-16010* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA
 Progress Report, 1 Dec. 1973 - 31 Jan. 1974

John W. Hannah, Garland L. Thomas, and Ferd Esparza, Principal Investigators 31 Jan. 1974 8 p Prepared in cooperation with Brevard County Planning Dept., Titusville, Fla. ERTS (Contract NAS5-21847)
 (E74-10248; NASA-TM-X-69380) Avail: NTIS HC \$3.00 CSCL 08B

N74-16011* Ohio Dept. of Economic and Community Development, Columbus.

RELEVANCE OF ERTS-1 TO THE STATE OF OHIO Semiannual Progress Report, 1 Jul. - 31 Dec. 1973

David C. Sweet, Paul G. Pincura, and George E. Wukelic, Principal Investigators 11 Jan. 1974 45 p Prepared in cooperation with Battelle Columbus Labs., Ohio Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21782)
 (E74-10250; NASA-CR-136564; SAPR-3) Avail: NTIS HC \$4.25 CSCL 08F

The author has identified the following significant results. During the first year of project effort the ability of ERTS-1 imagery to be used for mapping and inventorying strip-mined areas in south eastern Ohio, the potential of using ERTS-1 imagery in water quality and coastal zone management in the Lake Erie region, and the extent that ERTS-1 imagery could contribute to localized (metropolitan/urban), multicounty, and overall state land use needs were experimentally demonstrated and reported as significant project results. Significant research accomplishments were achieved in the technological development of manual and computerized methods to extract multi-feature information as well as singular feature information from ERTS-1 data as is exemplified by the forestry transparency overlay. Fabrication of an image transfer device to superimpose ERTS-1 data onto existing maps and other data sources was also a significant analytical accomplishment.

N74-16073# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).

FIRST RESULTS OF STUDIES IN THE FIELD OF EARTH OBSERVATIONS IN PREPARATION OF A PROGRAM IN EUROPE

Alf Loeffler 1973 12 p Presented at the 113th European Space Symp., London, 25-27 Jun. 1973

Avail: NTIS HC \$3.00

Applications of remote sensing of interest to small countries with highly developed infrastructures, such as West Germany, are mentioned. These include regional planning, environmental monitoring, agriculture and forestry, and fishery. Aircraft, satellite and space lab remote platforms, and missions are summed up.

ESRO

N74-16074# European Space Research Organization, Paris (France). Space Applications Div.

EARTH RESOURCES SATELLITES: THE INTEREST FOR EUROPEAN INDUSTRY

J. Plevin 1973 18 p refs Presented at the 13th European Space Symp., London, 25-27 Jun. 1973

Avail: NTIS HC \$3.00

The need for earth resources surveys in Europe is discussed, with special emphasis on satellite surveys. The present status of remote sensing in Europe is described from both scientific and industrial viewpoints. The present links between earth scientists and industry are outlined, and the future role of industry is discussed.

ESRO

N74-17060* California Univ., Berkeley. Space Sciences Lab. **AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON SKYLAB AND SUPPORTING AIRCRAFT DATA** Quarterly Progress Report Robert N. Colwell, James D. Nichols, Leonard W. Bowden, and Wes Chambers, Principal Investigators (Bureau of Land Management, Riverside, Calif.) 30 Nov. 1973 15 p EREP (Contract NAS2-7562)

(E74-10266; NASA-CR-136652) Avail: NTIS HC \$3.00 CSCL 08G

N74-17090* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

USE OF ERTS-1 DATA: SUMMARY REPORT OF WORK ON TEN TASKS Progress Report, 1 Jul. - 31 Dec. 1973

Frederick J. Thomson, F. C. Polcyn, M. Leonard Bryan, I. J. Sattinger, W. A. Malila, R. F. Nalepka, C. T. Wezernak, R. Horvath, and R. K. Vincent, Principal Investigators 25 Jan. 1974 80 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21783)

(E74-10301; NASA-CR-136771; ERIM-193300-37-P) Avail: NTIS HC \$6.00 CSCL 05B

The author has identified the following significant results. Depth mappings for a portion of Lake Michigan and at the Little Bahama Bank test site have been verified by use of navigation charts and on-site visits. A thirteen category recognition map of Yellowstone Park has been prepared. Model calculation of atmospheric effects for various altitudes have been prepared. Radar, SLAR, and ERTS-1 data for flooded areas of Monroe County, Michigan are being studied. Water bodies can be reliably recognized and mapped using maximum likelihood processing of ERTS-1 digital data. Wetland mapping has been accomplished by slicing of single band and/or ratio processing of two bands for a single observation date. Both analog and digital processing have been used to map the Lake Ontario basin using ERTS-1 data. Operating characteristic curves were developed for the proportion estimation algorithm to determine its performance in the measurement of surface water area. The signal in band MSS-5 was related to sediment content of waters by modelling approach and by relating surface measurements of water to processed ERTS data. Radiance anomalies in ERTS-1 data could be associated with the presence of oil on water in San Francisco Bay, but the anomalies were of the same order as those caused by variations in sediment concentration and tidal flushing.

N74-17106* Earth Satellite Corp., Berkeley, Calif.

PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Jan. 1974

Charles E. Poulton, Principal Investigator 31 Jan. 1974 31 p EREP

(Contract NAS9-13286)

(E74-10323; NASA-CR-136814) Avail: NTIS HC \$4.75 CSCL 08B

N74-17107* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Quarterly Progress Report, 1 Nov. 1973 - 31 Jan. 1974

John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 1 Feb. 1974 13 p Prepared in cooperation with Brevard County Planning Dept., Titusville, Fla. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (NASA Order CC-30281-A)

(E74-10324; NASA-TM-X-69862) Avail: NTIS HC \$4.00 CSCL 08B

N74-17125# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).

REMOTE SENSING OF EARTH RESOURCES. VIEWPOINTS OF EUROPEAN EARTH SCIENTISTS

T. S. Bowling, comp., S. R. Dauncey, comp., R. J. Haslam, comp., J. Noel, comp., J. Ogier, comp., B. Vidon, comp., Y. Vuillaume, comp., G. Weeksteen, comp., and H. Sturm, comp. Paris ESRO Jul. 1973 175 p Prepared jointly with Soc. d'Etudes Tech. et d'Entreprises Gen., Dornier-Werke G.m.b.H., Munich and Bur. de Rech. Geol. et Minières, Paris

(Contract ESTEC-1787/72)

(ESRO-CR-276) Avail: NTIS HC \$1.75

An inquiry was carried out among those members of the European geoscientific community who are interested in the remote sensing of earth resources. The objective was to obtain the opinions and advice of specialists in the ten ESRO member states on the following topics: interest and advisability of a European program of remote sensing; desirable objectives of such a program; and suggestions for its preparation and development. The results of the inquiry are given. ESRO

N74-17998*# North Carolina State Univ., Raleigh.

UTILIZATION OF ERTS-1 DATA IN NORTH CAROLINA Interim Report, Jun. - Nov. 1973

Charles W. Welby, Principal Investigator, J. O. Lammi, and R. J. Carson, III Jan. 1973 48 p refs ERTS

(Contract NAS5-21732)

(E74-10317; NASA-CR-136806) Avail: NTIS HC \$5.50 CSCL 08B

The author has identified the following significant results. ERTS-1 imagery has been used to study forested wetlands, dynamic processes off Coastal North Carolina, and land use patterns in the Wilmington, North Carolina area. The thrust of the investigation is still involvement of state and regional agencies in the use of ERTS-1 imagery in solving some of their day-to-day problems.

N74-17999*# North Carolina State Univ., Raleigh. Dept. of Geosciences.

UTILIZATION OF ERTS-A DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Progress Report, Dec. 1973 - Jan. 1974

Charles W. Welby, Principal Investigator 15 Feb. 1974 24 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21732)

(E74-10320; NASA-CR-136811) Avail: NTIS HC \$4.25 CSCL 08G

N74-18025*# California Univ., Berkeley. Space Sciences Lab. **AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report**

31 Dec. 1973 304 p refs

(Grant NGL-05-003-404)

(NASA-CR-136945) Avail: NTIS HC \$18.25

University of California investigations to determine the usefulness of modern remote sensing techniques have concentrated on the water resources of the state. The studies consider in detail the supply, demand, and impact relationships.

N74-18026* California Univ., Berkeley.

INTRODUCTION

Robert N. Colwell *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 31 Dec. 1973 7 p

CSCL 08F

Since May 1970, personnel on several campuses of the University of California have been conducting investigations which seek to determine the usefulness of modern remote sensing techniques for studying various components of California's earth resources complex. Emphasis has been given to California's water resources as exemplified by the Feather River project and other aspects of the California Water Plan. This study is designed to consider in detail the supply, demand, and impact relationships. The specific geographic areas studied are the Feather River drainage in northern California, the Chino-Riverside Basin and Imperial Valley areas in southern California, and selected portions of the west side of San Joaquin Valley in central California. An analysis is also given on how an effective benefit-cost study of remote sensing in relation to California's water resources might best be made. A.L.

N74-18030* California Univ., Berkeley. Dept. of Business Administration.

ON THE FEASIBILITY OF BENEFIT-COST ANALYSIS APPLIED TO REMOTE SENSING PROJECTS Special Study No. 1

Leonard Merewitz *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 31 Dec. 1973 7 p refs

CSCL 05A

The following step-wise procedure for making a benefit-cost analysis of using remote sensing techniques could be used either in the limited context of California water resources, or a context as broad as the making of integrated resource surveys of the entire earth resource complex on a statewide, regional, national, or global basis. (1) Survey all data collection efforts which can be accomplished by remote sensing techniques. (2) Carefully inspect the State of California budget and the Budget of the United States Government to find annual cost of data collection efforts. (3) Decide the extent to which remote sensing can obviate each of the collection efforts. (4) Sum the annual costs of all data collection which can be equivalently accomplished through remote sensing. (5) Decide what additional data could and would be collected through remote sensing. (6) Estimate the value of this information. It is not harmful to do a benefit-cost analysis so long as its severe limitations are recalled and it is supplemented with socio-economic impact studies. Author

N74-18034* California Univ., Berkeley. Center for Remote Sensing Research.

INTERCHANGE AND COOPERATION WITH USER AGENCIES Special Study No. 5

D. T. Lauer *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 31 Dec. 1973 27 p

CSCL 05B

It is apparent that the rate of remote sensing technique development is increasing at a much faster pace than is the rate at which these same techniques are being put to practical use by earth resource managers and inventory specialists. It has become increasingly important to 'bridge this widening gap between remote sensing specialists and potential users. Members of the University of California project on remote sensing of earth resources have been actively participating in efforts to overcome this gap by maintaining library facilities, disseminating research findings, training remote sensing specialists, and interacting with resource managers. A.L.

N74-18035* California Univ., Berkeley.

SUMMARY

R. N. Colwell *In its* An Integrated Study of Earth Resources in the State of Calif. Using Remote Sensing Tech. 31 Dec. 1973 20 p

CSCL 05B

University of California activities in the development of remote sensing techniques and their application in the study of water resources within the state are summarized. It is pointed out that the summary is very lengthy due to fact that NASA had requested a dramatic reorientation of the study. For this reason it was felt that the co-investigators and other participants, need

a rather detailed and systematic tabulation of the relevant facts that have been uncovered during the period since the reorientation.

A.L.

N74-18045* Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

EARTH RESOURCES APPLICATIONS OF THE SYNCHRONOUS EARTH OBSERVATORY SATELLITE (SEOS) Final Report, 21 May - 15 Oct. 1973

D. S. Lowe, J. J. Cook et al Dec. 1973 309 p refs

(Contract NAS5-21937)

(NASA-CR-132933; ERIM-103500-1-F) Avail: NTIS HC \$18.50 CSCL 05B

The results are presented of a four month study to define earth resource applications which are uniquely suited to data collection by a geosynchronous satellite. While such a satellite could also perform many of the functions of ERTS, or its low orbiting successors, those applications were considered in those situations where requirements for timely observation limit the capability of ERTS or EOS. Thus, the application presented could be used to justify a SEOS.

Author

N74-18060* Environmental Research Inst. of Michigan, Ann Arbor.

PROCEEDINGS OF THE 8TH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, VOLUME 2

Jerald J. Cook Oct. 1972 786 p refs Symp. held at Ann Arbor, Mich., 2-6 Oct. 1972 Sponsored in part by NASA

(Grant AF-AFOSR-2372-72; AF Proj. 9751)

(NASA-CR-137048; AFOSR-73-1120TR-Vol-2; AD-770489;

ERIM-195600-1-X-Vol-2) Avail: NTIS HC \$42.50 CSCL 08/6

The Proceedings contain papers presented at the Eighth International Symposium on Remote Sensing of Environment, held October 6th, 1972, on the campus of The University of Michigan. The symposium was conducted by the Center for Remote Sensing Information and Analysis of the Environmental Institute of Michigan (formerly the University of Michigan's Willow Laboratories) as a part of a continuing program investigating current activities in the field of remote sensing.

Author (GRA)

N74-18072* Earth Satellite Corp., Washington, D.C.

EVALUATION OF ECONOMIC, ENVIRONMENTAL AND SOCIAL COSTS AND BENEFITS OF FUTURE EARTH RESOURCE SURVEY SATELLITE SYSTEMS Quarterly Progress Report, Feb. - Apr. 1973

14 May 1973 234 p

(Contract DI-14-08-0001-13519)

(PB-224673/4GA; USGS-DO-73-010; QPR-1) Avail: NTIS HC \$13.75 CSCL 08F

Initial effort to analyze the economic, environmental, and social costs and benefits of future earth resource survey satellite systems has been to identify user requirements through a review of previous studies, identify earth resources survey information of value to application areas through a review of all ERTS-1 experiment information, to identify and describe user decisions and actions which are or might be influenced by earth resources survey data, particularly in the fields of agriculture and water resources, and to develop recommendations of case studies to be used later.

GRA

N74-18890* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STATION READINESS TEST FOR THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) MISSION

Mar. 1972 359 p

(NASA-TM-X-68582; STDN-401.1/ERTS)

Avail: NTIS

HC \$21.00 CSCL 22D

The purpose of this SRT is to establish testing procedures which will verify that ERTS supporting stations can effectively support the ERTS mission. This SRT is applicable to all supporting stations for the ERTS-A and ERTS-B mission.

Author

N74-18975* Earth Satellite Corp., Berkeley, Calif. 08b
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-28 Feb. 1974

Charles E. Poulton, Principal Investigator 28 Feb. 1974 8 p EREP

(Contract NAS9-13286)

(E74-10366; NASA-CR-137060; MPR-13) Avail: NTIS HC \$4.00

N74-19005* Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.

EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-28 Feb. 1974

Ernest E. Hardy, Principal Investigator 28 Jan. 1974 2 p EREP

(Contract NAS9-13364)

(E74-10397; NASA-CR-137215) Avail: NTIS HC \$4.00 CSCL 05B

N74-19010* Cornell Univ., Ithaca, N.Y. New York State Coll. of Agriculture and Life Sciences.

EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1-31 Nov. 1973

Ernest E. Hardy, Principal Investigator and Rodney Wulff 31 Nov. 1973 11 p ref EREP

(Contract NAS9-13364)

(E74-10402; NASA-CR-137226) Avail: NTIS HC \$4.00 CSCL 05B

N74-19019* Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

INFORMATION TO THE UNITED NATIONS RELATIVE TO THE BRAZILIAN ERTS FACILITY: COMPOSITION AND COSTS

Fernando Demendonca Apr. 1973 38 p Sponsored by UN (INPE-322-RI/103) Avail: NTIS HC \$5.00

Diagrams and charts describing the ERTS facility in Brazil are presented. The facility is composed of four parts: (1) tracking and receiving stations; (2) image processing station; (3) photographic processing station; and (4) data bank. A cost analysis for building this station is also given.

S.K.W.

N74-19044* Techtran Corp., Glen Burnie, Md.

STUDIES OF THE ENVIRONMENT FROM SPACE

K. Ya. Kondratyev Washington NASA Mar. 1974 9 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 7, 1971 p 108-111

(Contract NASw-2485)

(NASA-TT-F-14759) Avail: NTIS HC \$3.00 CSCL 08F

This review of studies conducted in the United States on the problem of investigating the environment from space, is based on materials of the 21st International Congress on Astronautics, held in West Germany in October 1970.

Author

N74-19485* Joint Publications Research Service, Arlington, Va.

LEGAL ASPECTS OF MANNED SPACEFLIGHT AND REMOTE SENSING OF THE ENVIRONMENT

A. I. Rudev and V. S. Vereshchetin 29 Mar. 1974 20 p refs Transl. into ENGLISH from Sovetskoye Gosudarstvo i Pravo (Moscow), no. 1 and 4, 1972 p 111-115, 121-124

(JPRS-61614) Avail: NTIS HC \$4.00

An examination is presented of international cooperation and law on manned spaceflight, and on environmental studies from space.

N74-19486 Joint Publications Research Service, Arlington, Va.
MANNED SPACE STATIONS IN CIRCUMTERRESTRIAL ORBITS

A. I. Rudev and V. G. Emin *In its Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment* (JPRS-61614) 29 Mar. 1974 p 1-10 refs Transl. into ENGLISH from Sovetskoye Gosudarsto i Pravo (Moscow), no. 4 p 111-115

International laws for space activities in manned earth orbital missions are discussed. Regulatory measures already taken by the U.N. are reviewed. The following suggestions are made for areas in which future regulations may be required: (1) measures to insure the fair distribution of information from earth resources flights to all nations; (2) assignment of safe orbits for launching, and special distribution of geostationary orbits; (3) international registry of all spacecraft; (4) control of radiation safety hazards, especially with regards to nuclear rocket engines; (5) systems for the removal of rubbish from space; and (6) measures to provide for international cooperation in astronaut rescue operations, such as having stationary rescue vehicles with standard apparatus for approach and docking.
 S.K.W.

N74-19487 Joint Publications Research Service, Arlington, Va.
ENVIRONMENTAL STUDIES FROM SPACE

V. S. Vereshchetin *In its Legal Aspects of Manned Spaceflight and Remote Sensing of the Environment* (JPRS-61614) 29 Mar. 1974 p 11-19 refs Transl. into ENGLISH from Sovetskoye Gosudarsto i Pravo (Moscow), no. 1 p 121-124

The regulation of environmental information from remote sensing spacecraft is discussed in terms of the sovereign rights of nations. It is recommended that commercial use of this data not be permitted without a country's knowledge and consent.
 S.K.W.

N74-19610# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SUMMARY OF SPACE ACTIVITIES IN BRAZIL

1973 136 p refs Presented at COSPAR Plenary Meeting, Konstanz, West Germany, 1973.
 (INPE-334-LAFE) Avail: NTIS HC \$10.00

Summaries of research activities in space, natural resources, technology transference, and communications are presented. The coordination and planning of these projects are also discussed.
 S.K.W.

N74-19931 Pennsylvania Univ., Philadelphia.

A COST/PERFORMANCE ANALYSIS OF AIRCRAFT AND SATELLITES USED AS EARTH RESOURCES SURVEY VEHICLES Ph.D. Thesis

Charles Edward Cheeseman, Jr. 1973 171 p

Avail: Univ. Microfilms Order No. 74-2396

The problem of designing, in a generalized manner, a data collection system to conduct earth resources surveys is examined. Systematic modelling of the essential performance and economic characteristics of an aircraft-satellite system for such a purpose is introduced. The modelling process involves: (1) the generation of a set of variables which could be used to specify user information requirements in terms meaningful to the designer, (2) the derivation of spatial and temporal relationships which permit the transformation of the user requirements into unit cost elements, and (3) the development of cost information for various fixed and operating costs.
 Dissert. Abstr.

N74-19954# Earth Satellite Corp., Berkeley, Calif.

PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Mar. 1974

Charles E. Poulton, Principal Investigator 31 Mar. 1974 15 p EREP

(Contract NAS9-13286)

(E74-10420; NASA-CR-137279; MPR-14) Avail: NTIS HC \$4.00 CSCL 08B

N74-19967# Techtran Corp., Glen Burnie, Md.

SPACE ECOLOGY (BASED ON MATERIALS OF 22D INTERNATIONAL CONGRESS ON ASTRONAUTICS

K. Ya. Kondratyev Washington NASA Mar. 1974 14 p refs Transl. into ENGLISH from Meteorol. Gidrol. (Moscow), no. 5, 1972 p 108-113

(Contract NASw-2485)

(NASA-TT-F-14760) Avail: NTIS HC \$4.00 CSCL 08F

Reports on the problem of utilization of satellites for studying natural resources of the earth, presented at the 22nd International Congress on Astronautics, are reviewed.
 Author

N74-19969# Kanner (Leo) Associates, Redwood City, Calif.
ADVANCED RESULTS OF THE FIRST EXPEDITION AFTER A PROGRAM OF COMPLEX ENERGY EXPERIMENTS (KENEX-70)

K. Ya. Kondratyev, B. F. Belov, O. B. Vasilev, L. S. Ivlev, S. P. Malevskiy, L. R. Orlenko, O. I. Popov, Yu. I. Rabinovich, N. E. Ter-Markaryan, and L. I. Chapurskiy Washington NASA Mar. 1974 18 p refs Transl. into ENGLISH from Byull. VMO (USSR), v. 20, no. 3, 1971 p 1-11

(Contract NASw-2481)

(NASA-TT-F-14765) Avail: NTIS HC \$4.00 CSCL 04A

Results are presented of the first expedition of the Kenex program, carried out in the desert regions of Central Asia. The main aim of the expedition was to carry out research into the ground layer and free atmosphere. However, other subjects investigated were the energy effects on the underlying surface and heat flows in the atmosphere. Aircraft and helicopters carried out measurements and readings of spectral and integral radiation flows and temperature, moisture and aerosol profiles. Observations made by a ground party at Repetek were directed at wind speeds, moisture, temperature gradients in the 15-m layer and radiation flows at other levels. Tables show the results obtained at this stage.
 Author

N74-19971# Kanner (Leo) Associates, Redwood City, Calif.
COSMIC DISTANCE INDICATION OF THE NATURAL ENVIRONMENT

K. Ya. Kondratyev Washington NASA Mar. 1974 13 p refs Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 10, 1972 p 41-46

(Contract NASw-2481)

(NASA-TT-F-14766) Avail: NTIS HC \$4.00 CSCL 08F

The role of different manned and unmanned spacecraft in studying the earth's natural environment is discussed. Data from space technology in the areas of ecology, meteorology, and oceanography are summarized. The use of multispectral photography and atmospheric sounding from satellites is also discussed.
 K.M.M.

N74-20001# Earth Satellite Corp., Washington, D.C.

EVALUATION OF ECONOMIC, ENVIRONMENTAL AND SOCIAL COSTS AND BENEFITS OF FUTURE EARTH RESOURCES SURVEY SATELLITE SYSTEMS Quarterly Progress Report, May - Jul. 1973

10 Aug. 1973 322 p refs

(Contract DI-14-08-0001-13519)

(PB-226036/2GA; USGS-DO-73-014; QPR-2) Avail: NTIS HC \$18.25 CSCL 08F

A case study in agriculture crop acreage estimation was initiated and preliminary efforts were made to define resources, rangeland management, and land use planning. Progress to date leads to these observations: The ERTS-1 experimental results thus far represent relatively few data points. Applications of high potential benefits often depend on the redesign of a complex management information system to convert information extracted from ERS data into the form used in management decisions. Benefit measurement techniques appear to present fewer problems than experimental results or the management information models. The case studies defined to date vary substantially in their breadth of coverage.
 GRA

N74-20953# Ecosystems International, Inc., Gambrills, Md.
THE PRACTICAL UTILIZATION OF REMOTE SENSING TECHNOLOGY FOR THE MANAGEMENT AND CONSERVATION OF NATURAL RESOURCES. PART 1: CROP

FORECASTING

Peter A. Castruccio and Harry L. Loats, Jr. Mar. 1974 64 p
 refs Sponsored by NASA ERTS
 (E74-10425; NASA-CR-137351) Avail: NTIS HC \$6.25 CSCL
 02C

N74-20955*# Cornell Univ., Ithaca, N.Y. New York State
 Coll. of Agriculture and Life Sciences.

**EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION
 SERVICE FOR INVESTIGATING LAND USE AND NATURAL
 RESOURCES (SKYLAB) Progress Report, 1-31 Mar. 1974**
 Ernest E. Hardy, Principal Investigator 31 Mar. 1974 2 p
 EREP

(Contract NAS9-13364)
 (E74-10428; NASA-CR-137364) Avail: NTIS HC \$4.00 CSCL
 08B

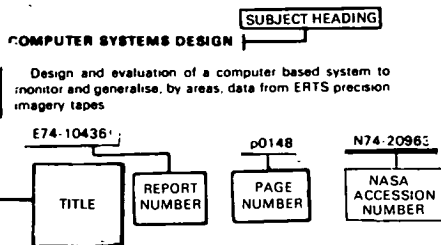
N74-21609# Executive Office of the President, Washington,
 D.C.

**AERONAUTICS AND SPACE REPORT OF THE PRESIDENT,
 1973 ACTIVITIES**
 1973 136 p

Avail: NTIS MF \$1.45; SOD HC \$1.70

The space and aeronautical activities of federal departments
 and agencies are summarized. Technologies for acquiring and
 analyzing information about the earth, its environment, and its
 resources from aircraft and spacecraft are outlined. The Earth
 Resources Technology Satellite is an example of this type of
 research. Progress in understanding man's ability to live and
 work in space for extended periods is discussed. Defense activities
 include further development and implementation of satellite based
 communications and navigation systems, development of new
 military aircraft, and construction of Advanced Medium STOL
 Transport Prototypes, which may be used for civil transport as
 well. The development, operation and support of civil and military
 space applications such as meteorology, communications, and
 earth observations is also discussed. Author

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. The title is used to provide a description of the subject matter. The NASA or AIAA accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of the supplement). If applicable a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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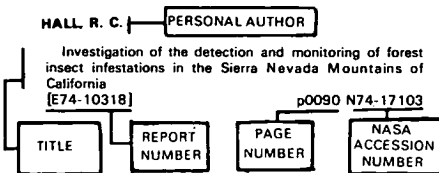
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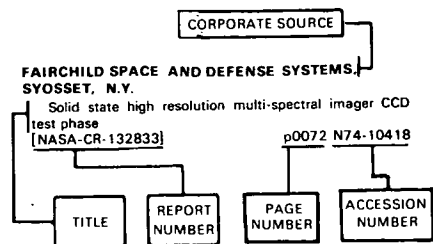
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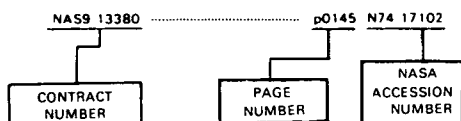
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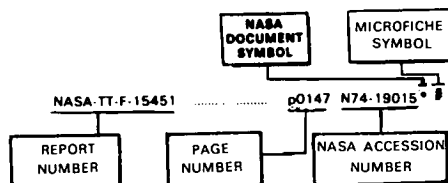
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